Iron and Steel ENGINEER

ENGINEERING SERVICE TO THE IRON AND STEEL INDUSTRY SINCE 1907

FEBRUARY, 1952

TECHNOLOGY DEPT.
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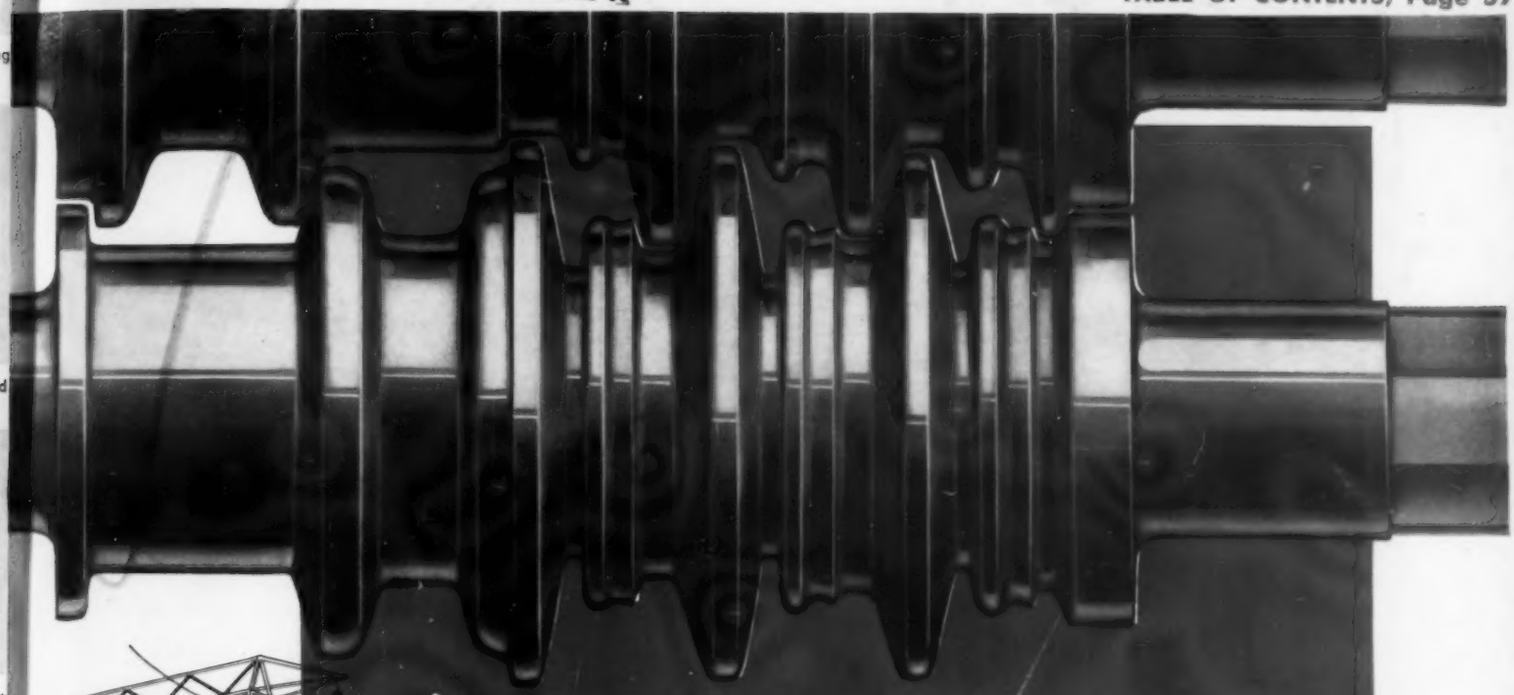
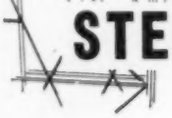
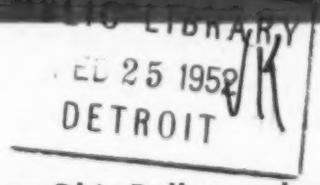


Ohio Rolls

SHAPING METAL FOR ALL INDUSTRY





STEPPED-UP PRODUCTION

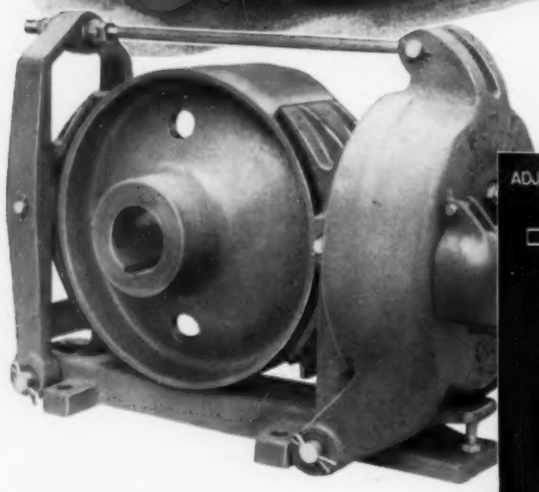
Greatly-enlarged plant facilities at Lima mean more Ohio Rolls to enhance your production. Choose from 11 types of Ohio Iron and Steel Rolls:

Carbon Steel Rolls
Ohioloy Rolls
Ohioloy "K" Rolls
Holl-O-Cast Rolls
Chilled Iron Rolls
Denso Iron Rolls
Nickel Grain Rolls
Special Iron Rolls
Nioloy Rolls
Flintuff Rolls
Ohio Double-Pour Rolls

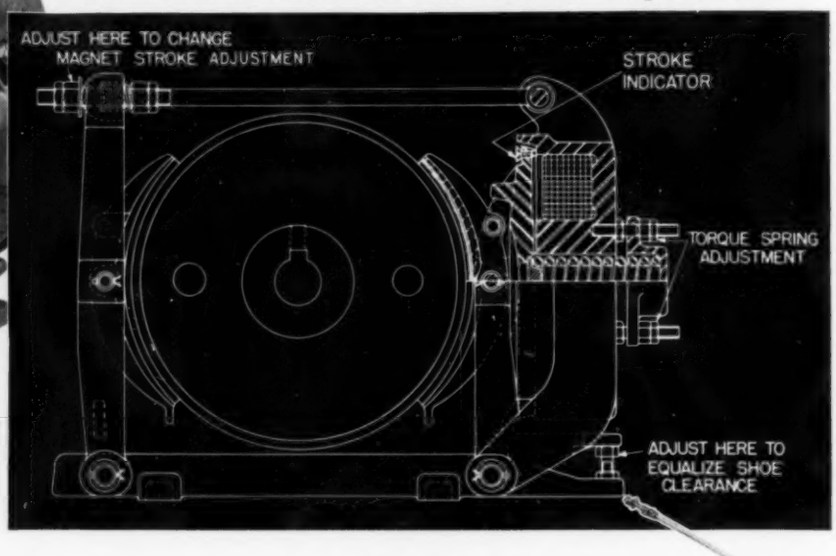
THE OHIO STEEL FOUNDRY CO.

LIMA, OHIO • PLANTS AT LIMA AND SPRINGFIELD, OHIO

Still the Leader!



The design of the Type M Brake is so fundamentally correct its performance has never been equalled


ADJUST HERE TO CHANGE MAGNET STROKE ADJUSTMENT
STROKE INDICATOR
TORQUE SPRING ADJUSTMENT
ADJUST HERE TO EQUALIZE SHOE CLEARANCE

Common sense says there *must* be a best way of doing *any* job. It follows as a consequence any method not equal to the best *cannot* produce equal results. There never has been a mill brake as simple in design or as direct in application of braking power as the Cutler-Hammer Type M Brake. And if the popularity of this brake through the years is a criterion, there never has been a brake to equal it in performance.

The action is a direct push of the shoes against the wheel. Since both the field member and armature move in braking and release, action is lightning fast. The simple design eliminates parts that usually cause trouble and need adjustment and repair. Tough lining matched with durable alloy steel wheel reduces lining wear. Take-up adjustments are needed only at long intervals. Many heavy duty installations prove the Type M Brake to have no equal in performance. Write for Publication BR-2 giving full facts on this brake. CUTLER-HAMMER, Inc., 1255 St. Paul Avenue, Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

14 FACTS about Type M Brake

- √ Fundamental design proved by years of service in heavy duty applications
- √ The simplest of all brakes
- √ Has the fewest parts
- √ The brake with the fastest action
- √ The only brake with one-to-one magnet and total shoe stroke
- √ The brake with only 3 simple adjustments
- √ Longest service without take-up adjustments
- √ Tough long-life lining matched with hard Hammerloy steel wheel
- √ Cover-all tubes shield full length of hinge pins against paint, dirt, etc.
- √ Renewable hardened hinge pin bushings
- √ Hard sheet aluminum magnet coil cover plate caulked in place with aluminum wire
- √ Torque spring compression CANNOT be released manually
- √ Torque spring fully protected
- √ Brass friction plugs keep shoes always aligned

All of these features are also provided, when used on A.C. Service with rectifier

CUTLER-HAMMER
MOTOR CONTROL
C-H

It Set the Pattern Years Ago • It has Set the Pace Ever Since

IRON AND STEEL ENGINEER; published monthly by Association of Iron and Steel Engineers, 1010 Empire Bldg., entered as second class matter January 25, 1924 at Pittsburgh, Pennsylvania, under Act of Congress, March 3, 1879. $7.50 per year in United States and Canada, $10.00 foreign countries. Volume 29, No. 2

● *Attention: Roll Users and Buyers . . .*

Aetna-Standard has completed their new roll foundry in Elwood City. The company will continue to manufacture and furnish rolls, as they have for the past 40 years, specializing in medium size and small rolls for Tube and Pipe; Rod and Structural; Bar, Billet and Sheet; Rubber and Plastic Mills. Types include Plain Chill, Moly Chill, Nickel Chill, Alanite Special, Alanite, Grain, Asex, Asex Special and Nodular Iron. *Your inquiries on rolls to Aetna-Standard will be answered promptly and efficiently.*

Aetna-Standard

THE AETNA-STANDARD ENGINEERING COMPANY • PITTSBURGH, PA.

Plants in Warren, Ohio · Ellwood City, Pennsylvania

ASSOCIATED COMPANIES

Head Wrightson Machine Company, Ltd., Middlesbrough, England — Great Britain, Finland, Sweden, Norway, Denmark, Union of South Africa, Northern and Southern Rhodesia.

Aetna-Standard Engineering Company, Ltd., Toronto, Ontario, Canada.

M. Castellvi, Inc., New York, N. Y. — Mexico, Central and South America.

Societe de Constructions de Montbard, Paris, France — France, Belgium, Holland, Luxembourg, Switzerland.

Demag Aktiengesellschaft, Duisburg, Germany — Germany, Austria, Yugoslavia, Greece, Turkey, Egypt.

Compagnia Italiana Forme Acciaio, Milano, Italy — Italy.

Aetna-Japan Company, Ltd., Tokyo, Japan — Japan.

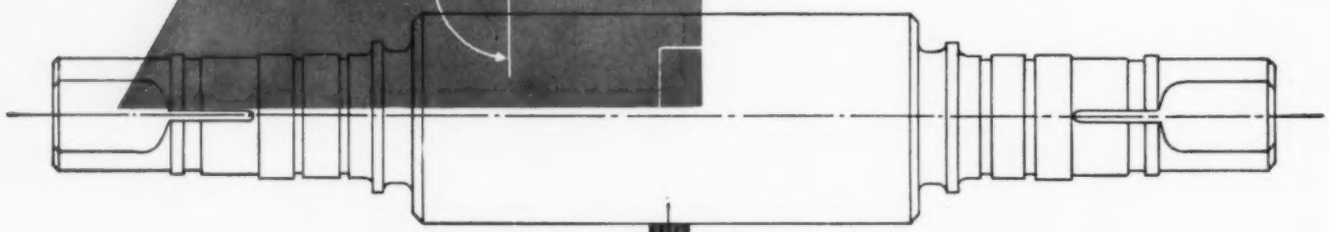
Hale & Kullgren, Inc., Akron, Ohio — Representative for the Rubber Industry.

Designers and Builders to the Ferrous, Non-Ferrous, Leather and Rubber Industries

GOT A ROLL PROBLEM?

Because of their technical knowledge of metals and metallurgy and their practical experience, our metallurgical staff has been helpful in solving many roll and rolling problems . . . And they have at their disposal modern laboratories for physical testing and research.

Why not call on them to help you solve your roll problems.



NATIONAL ROLLS

SPECIALISTS IN IRON AND ALLOY IRON ROLLS AND CASTINGS

THE NATIONAL ROLL & FOUNDRY CO.
AVONMORE, PENNSYLVANIA

Give your Oil Film Roll Necks EXTRA PROTECTION

...lubricate with TEXACO REGAL OIL

With *Texaco Regal Oil* in the circulating system, your back-up roll necks will roll on a super-tough lubricating film designed to carry heavy loads under all operating conditions. Thus you'll get smoother operation, longer bearing life, lower maintenance costs.

There is a complete line of *Texaco Regal Oils*—all turbine-quality for bearings in heavy-duty service. Because of their high resistance to oxidation, emulsification and sludging, *Texaco Regal Oils* keep circulating systems clean, assure a constant flow of cooling lubricant to maintain normal bearing temperatures.

In your enclosed reduction gears, use *Texaco Meropa Lubricant.* It resists oxidation, will not foam . . . assures longer gear life and lower maintenance costs.

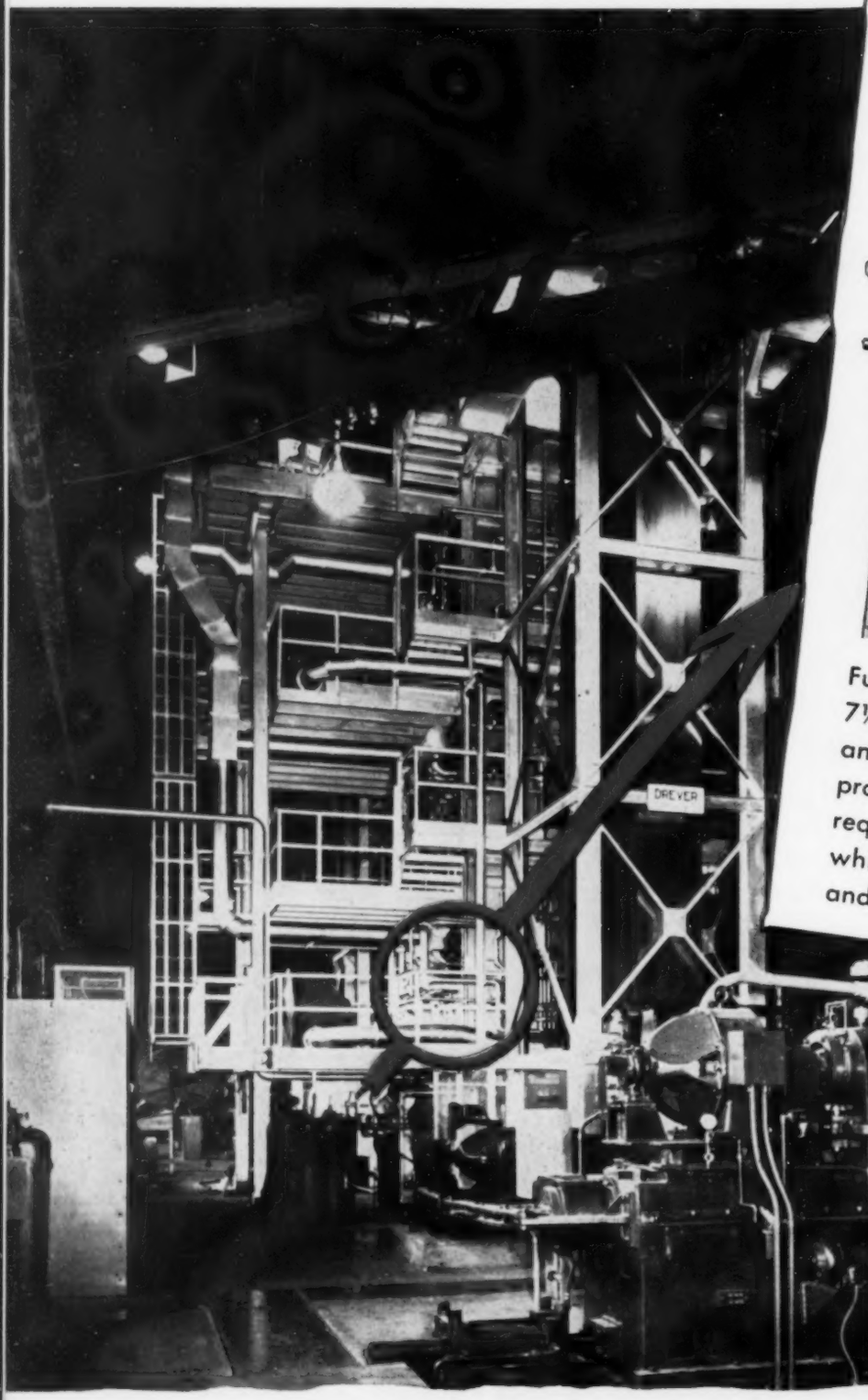
Let a Texaco Lubrication Engineer work with you to raise efficiency and lower costs throughout your mill. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO Regal Oils
(HEAVY CIRCULATING OILS)

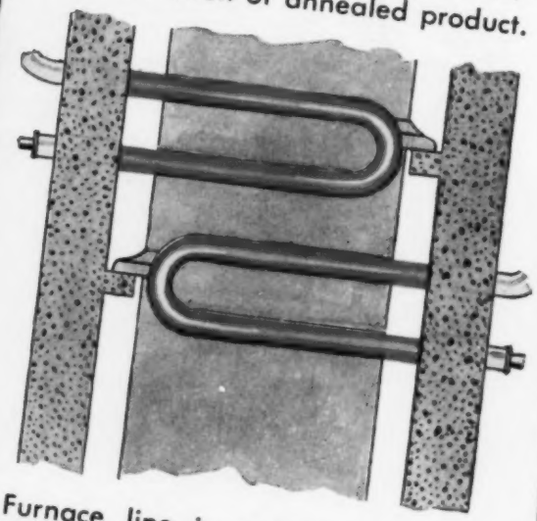
Faithfully yours 50 *for Fifty Years*

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

WILSON RADIANT TUBES HEAT THIS DREVER TOWER TYPE ANNEALER!



TUBES handle up to 175,000 BTU/hour input per tube operating at an average operating tube temperature of 1800°F giving an overall average economy of 1,000,000 BTU/ton of annealed product.



Furnace line is producing up to 7½ tons per hour of either bright annealing Tin Plate or Blue Plate, production being dependent upon required temper, width of strip, which ranges between 24" up to 32" and gauges from .009" to .015".

Lee Wilson

ENGINEERING Co., Inc.

20005 WEST LAKE ROAD • CLEVELAND, OHIO

Telephone ED-1-6600

BELL TYPE FURNACES + RADIANT TUBE HEATING + ANNEALING PROCESSES

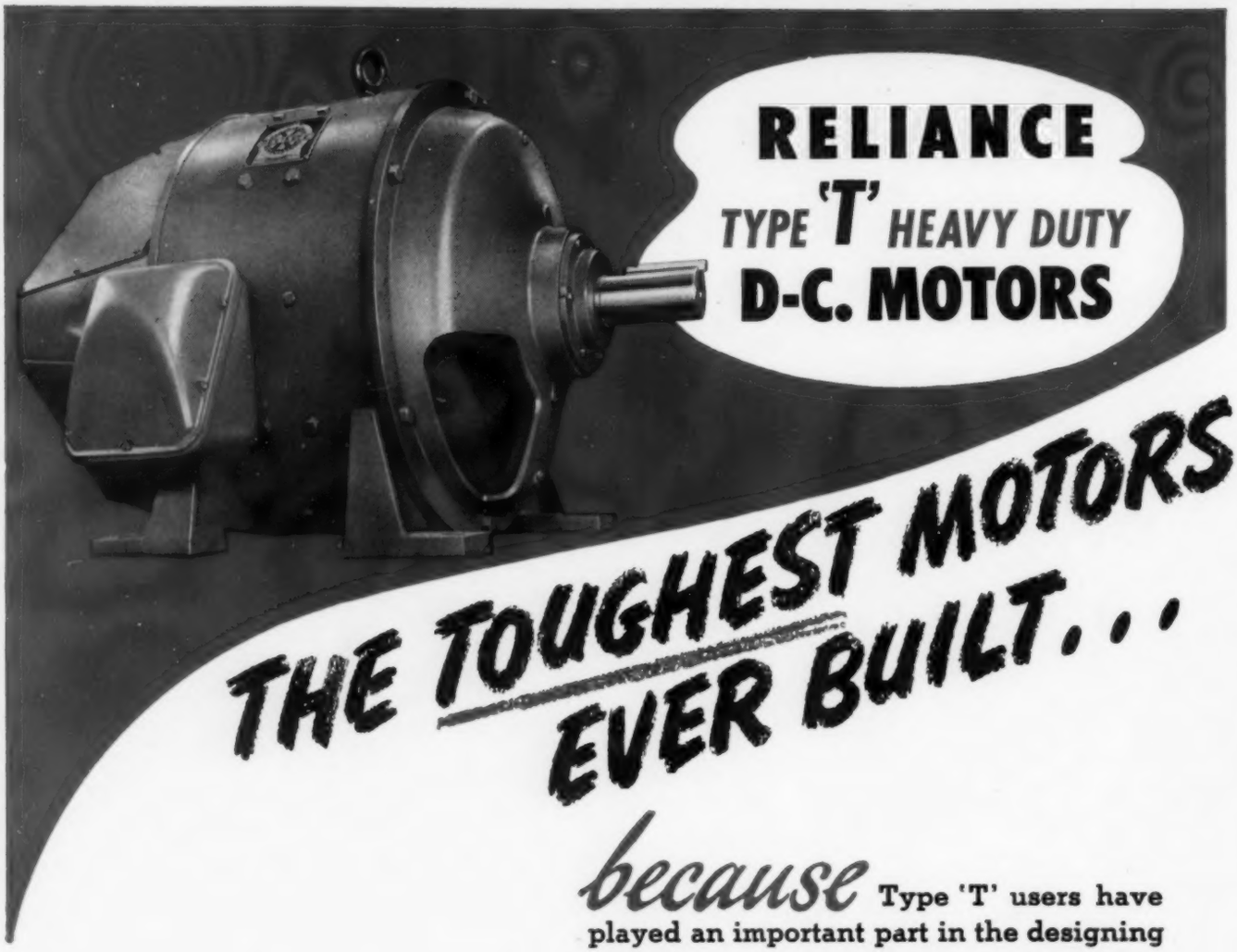
MACHINE SHOPS AT MESTA

Mesta is equipped to build the unusual. Unequalled plant facilities . . . the most modern machinery, including heavy duty lathes, grinders, boring mills, planers, draw-cut shapers, and gear hobbers . . . skilled workmen with long service records are all responsible for Mesta's ability to produce precision, heavy duty equipment.

Designers and builders of Complete Steel Plants

MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA



RELIANCE
TYPE 'T' HEAVY DUTY D-C. MOTORS

THE TOUGHEST MOTORS EVER BUILT...

because Type 'T' users have played an important part in the designing and the constant improvement of these motors to meet all of the rugged service conditions encountered today in plants, mills and mines.

Heavy duty, double-taped coils, for example, are impregnated with a wear-resistant polymerizing varnish which assures unsurpassed mechanical protection. For other important construction features, mechanical designs, dimensions and selection data, write for Bulletin C-2001.

Constant and adjustable-speed Type 'T' Heavy Duty D-c. Motors are available from ¾ through 1000 horsepower.

Type 'T' Heavy Duty D-c. Motor Frame with 6-pole field windings

Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

"Motor-Drive Is More Than Power" • 1084 Ivanhoe Road, Cleveland 10, Ohio

Continental

ALLOY BAR MILL

Rolling Mill installations engineered complete

for steel, alloy and non-ferrous metals

BLOOMING MILLS
STRUCTURAL MILLS
RAIL MILLS
BILLET MILLS
ROD MILLS
BAR MILLS
MERCHANT MILLS

★ ★ ★

SLABBING MILLS
UNIVERSAL MILLS
PLATE MILLS
HOT STRIP MILLS
COLD STRIP MILLS
TEMPER MILLS

★ ★ ★

Mills complete with Auxiliary Equipment

★ ★ ★

ROLL LATHES

★ ★ ★

SPECIAL MACHINERY

★ ★ ★

CASTINGS—carbon and alloy steel from 20 to 250,000 pounds

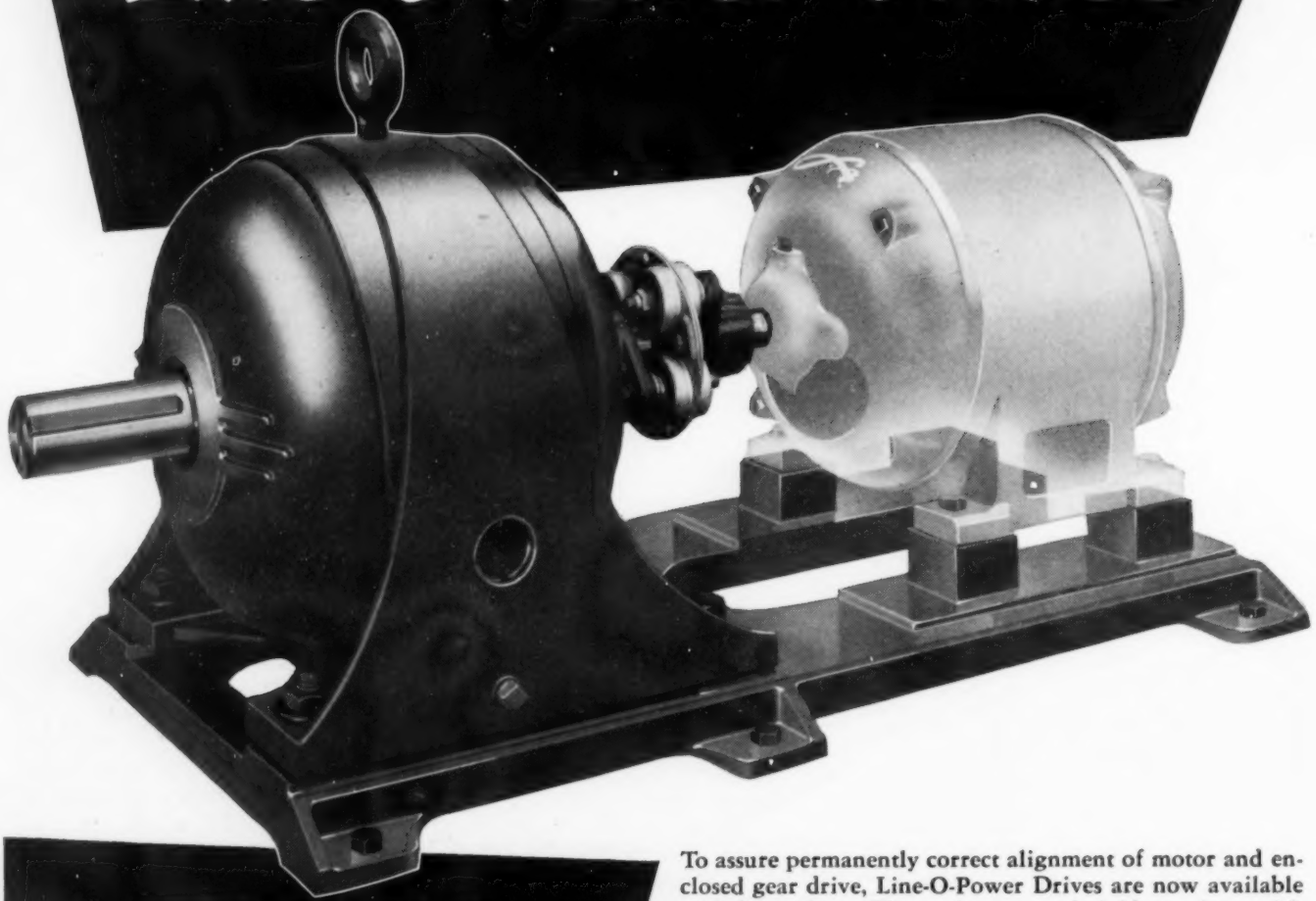
ROLLS—iron, alloy iron and steel rolls for all types of rolling mills

CHICAGO • PITTSBURGH

Plants at:
East Chicago, Ind.
Wheeling, W. Va.
Pittsburgh, Pa.

CONTINENTAL
Foundry & Machine
Company

Line-O-Power drives

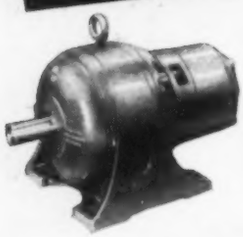


PACKAGED WITH BASE PLATE AND COUPLING READY FOR INSTALLATION OF YOUR OWN MOTOR

To assure permanently correct alignment of motor and enclosed gear drive, Line-O-Power Drives are now available with base plates. These plates are of rigid cast iron with smooth surfaces and rounded corners, making an attractive installation. Their use assures rapid assembly of units and prevents misalignment of shafts.

Faces of lugs on which unit and motor are mounted are precision machined, and bolt holes are accurately drilled and spaced.

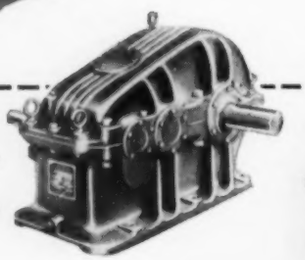
Line-O-Power straight line helical gear drives with Duti-Rated high hardness gears offer economy in original cost and economy in operation. They are available with or without base plates for prompt delivery. Write for prices and complete information or see the Foote Bros. representative near you.



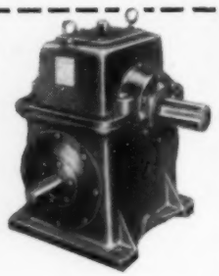
Foote Bros.-
Louis Allis
Gearmotors

FOOTE BROS.

Better Power Transmission Through Better Gears



Maxi-Power
Helical
Gear Drives



Hygrade
Enclosed Worm
Gear Drives

Foote Bros. Gear and
Machine Corporation
Dept. IAS, 4545 S. Western Ave.
Chicago 9, Illinois

Please send me Bulletin LPC containing complete information on Line-O-Power Drives and base plates.

Name.....

Address.....

City..... State.....

The hard, cold facts about Pittsburgh's hot furnaces!

47 PLANTS OKAY THE HEAT PROVER

Pittsburgh's great steel industry needed an instrument to measure air infiltration, to check air requirement and fuel-air ratio controls in open-hearth furnaces . . . an instrument to check the stoves in which blast-furnace air is heated . . . to check precise atmospheres in soaking pits . . . to control fuel waste and precise atmospheres in processing furnaces.

THE CITIES SERVICE HEAT PROVER WAS THE ANSWER . . . and it received the stamp of approval from engineers in 47 different mills in and around Pittsburgh!

Cities Service Heat Provers . . . *not an instrument you buy, but a service we supply* . . . helped to boost furnace productivity through these five unique advantages:

1. Rapid continuous sampling.

2. Simultaneous reading of oxygen and combustibles.

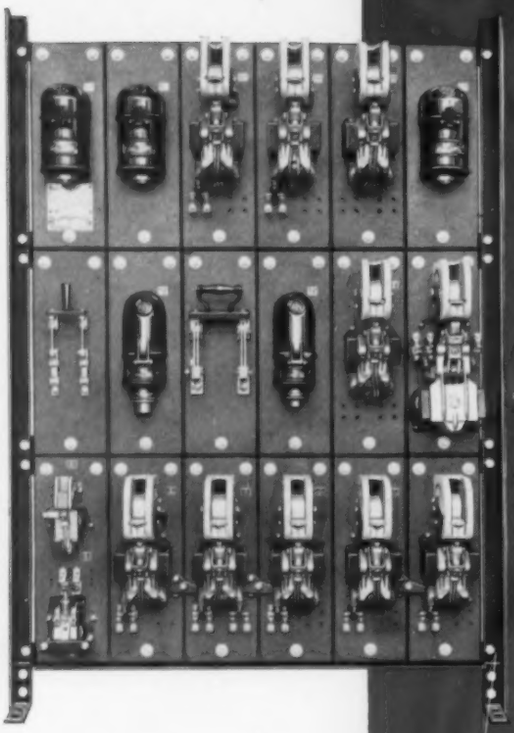
3. Direct measurement of oxygen and combustibles.

4. Easy portability.

5. No maintenance; no re-calibration.

These points begin to tell you why Cities Service Heat Prover analyses are just as much favored in glass, ceramics, steam generation and other fields as in the great Pittsburgh steel area. For the full story as it applies to you, write CITIES SERVICE OIL COMPANY, Dept. B-17, Sixty Wall Tower, New York City 5.

CITIES SERVICE



LOOK for these NAMES when buying Motor Control

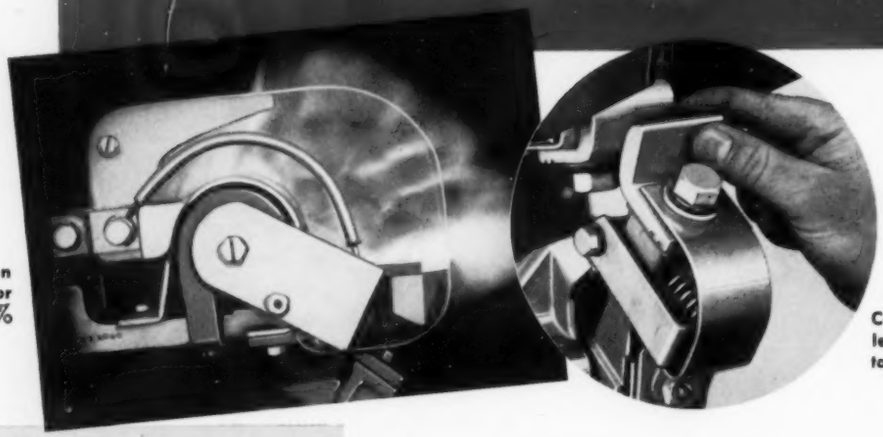
1 LINE-ARC Contactors
2 TIME-CURRENT Acceleration (D-c)
3 FREQUENCY RELAY Acceleration (A-c)
4 WRIGHT CIRCUIT Hoist Control (D-c)
5 YOUNGSTOWN Hoist Limit Stops
6 TYPE WB Brakes
7 CAM Master Switches
8 MANUAL-MAGNETIC Disconnect Switches
9 CONTRA-TORQUE Hoist Control (A-c)
10 TAB-WELD Resistors

These FUNCTIONAL NAMES Speak for Themselves

WITH LINE-ARC REG. U.S. PAT. OFF. CONTACTORS

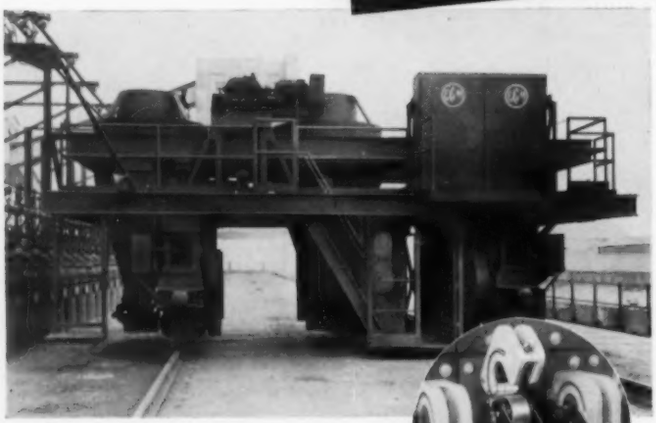
Upkeep is LOWER because

Destructive burning of arc shields is eliminated as evident in the following statement.

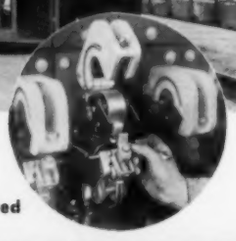


Glass arc shields on demonstration contactor are unharmed as 300% load is interrupted.

Cool operation lengthens contact life.



Koppers Larry Car for charging coal into ovens, using LINE-ARC contactor controllers.

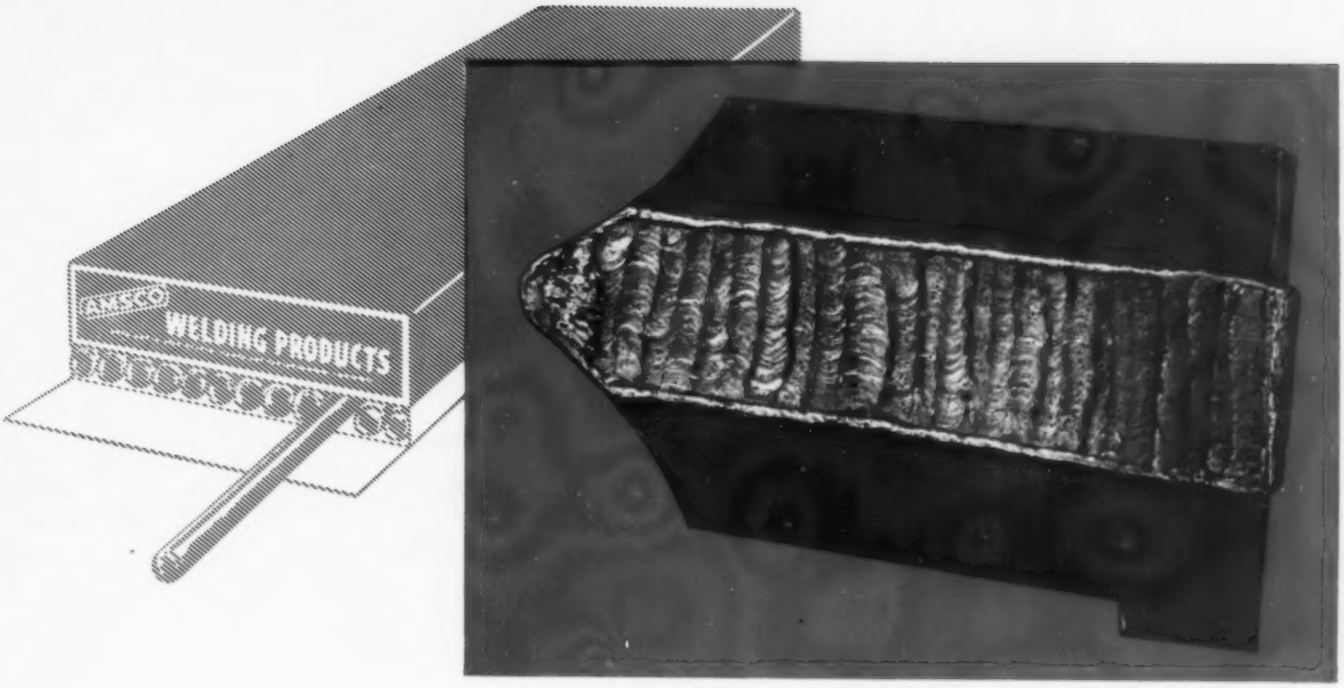


Contacts are easily reached with standard wrench.

EC&M LINE-ARC Contactor Control has earned a far-reaching reputation. *Operators* like the quick response, the ease of getting motors under way, the ability to inch accurately. *Maintenance men* appreciate the fewer upkeep problems, and when attention is needed, the ease of inspection or replacement of parts. *Plant managers* value the freedom from shutdowns, welcome the low operating expense.

Let an EC&M engineer assist in revamping existing installations — in planning control matched to new requirements.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO



How to run more tonnage — with fewer shutdowns

How to Amscoat Mill Guides . . .

This procedure sheet gives complete details . . . the AMSCO electrode to use and method of application. Also lists electrode recommendations for other iron and steel applications. Free copy on request.

An example of how AMSCOATING with Amsco Hardfacing Electrodes can save materials, manpower and money.

A large Eastern seamless steel pipe manufacturer can quote—from the record—on the big savings possible through Amscoating!

Before Amscoating, Mill Guides had to be removed and reground after running an average of 1200 tons. After Amscoating with an Amsco electrode specially developed to stand up under heat and abrasion, the same guides ran 37,117 tons without grinding—*over 30 times longer*—and were still in good condition for further service!

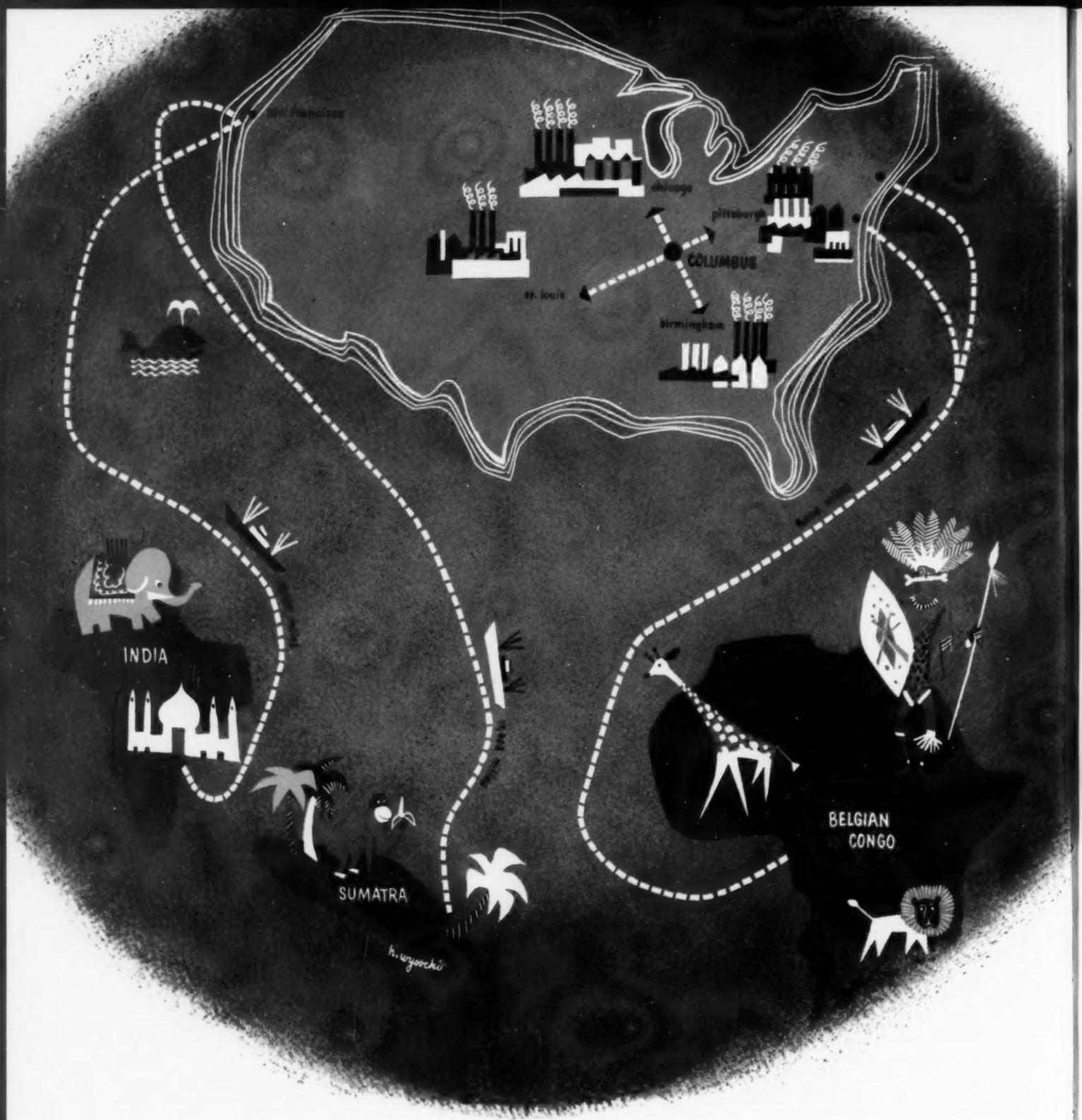
Amscoating can reduce shutdowns, repairs and replacements, as demonstrated by this actual case history. The inevitable result is that production goes *up* . . . and maintenance costs *down.* Write today for catalog on dollar-saving Amsco Electrodes and name of your nearest Amsco Distributor.

AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
411 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.



Not half a world away . . . but right in the heart of the industry

The map tells the story. Contrast the complications in obtaining palm oil from foreign-controlled sources with the reassuring ease of getting its new domestic replacement, *Palmoshield*. For the imported product: harvesting, extracting, refining, transporting to port, loading on tanker, shipping 8000 miles or more to U.S., unloading for tank storage, reheating and reloading for shipment to customers. For domestic *Palmoshield* a call to Ironsides in centrally located Columbus brings immediate shipment with delivery in no way dependent on uncertain world conditions.

New All-American Lubricant for Cold Rolling Operations

FROM The Ironsides Company of Columbus, Ohio, comes another important contribution to the American steel industry.

It is Palmoshield, the first workable replacement for imported palm oil . . . a 100% domestic product which frees U. S. tin plate producers from dependence on foreign sources for the essential lubricant in rolling operations.

All-American Palmoshield duplicates every chemical characteristic of the imported oil. It looks like palm oil, feels like palm oil, acts like palm oil, handles like palm oil and requires absolutely no changes in rolling mill operation. It is superior to palm oil in that it is subject to exact chemical control.

Tested for three years in actual rolling mill operation

Palmoshield has been under continuous testing for the past three years in cold rolling steel production under standard operating conditions.

Rolling characteristics are equal to palm oil. The cleaning operation is above average. Annealing and temper rolling are up to standard in every way. Tinning, both hot dip and electrolytic, yields a most satisfactory product. During this testing, the new Ironsides lubricant was reclaimed with good results both as to yield and product.

Tests prove four advantages over imported palm oil

1. *Palmoshield is widely available in this country. Users are not dependent on shipping during unsettled world conditions.*
2. *The domestic materials which go into Palmoshield are so freely available as to supply all steel production of the United States without "borrowing" from other defense requirements.*
3. *Due to its availability, Palmoshield need not be stockpiled. However, there is no deterioration from extended storage.*
4. *Palmoshield is subject to exact chemical control. The free fatty acid content does not vary from batch to batch and can be specified by the user.*

Palmoshield now in commercial production

With testing completed and production on a commercial basis, Palmoshield is now available for immediate shipment to steel companies in 55-gallon drums and in tank car lots. It is competitively priced. For complete details call or write The Ironsides Company, 270 West Mound Street, Columbus, Ohio. Upon request, the Ironsides representative in your area will call and give you full information in person.

Tough lubrication problem? Call on Ironsides first!

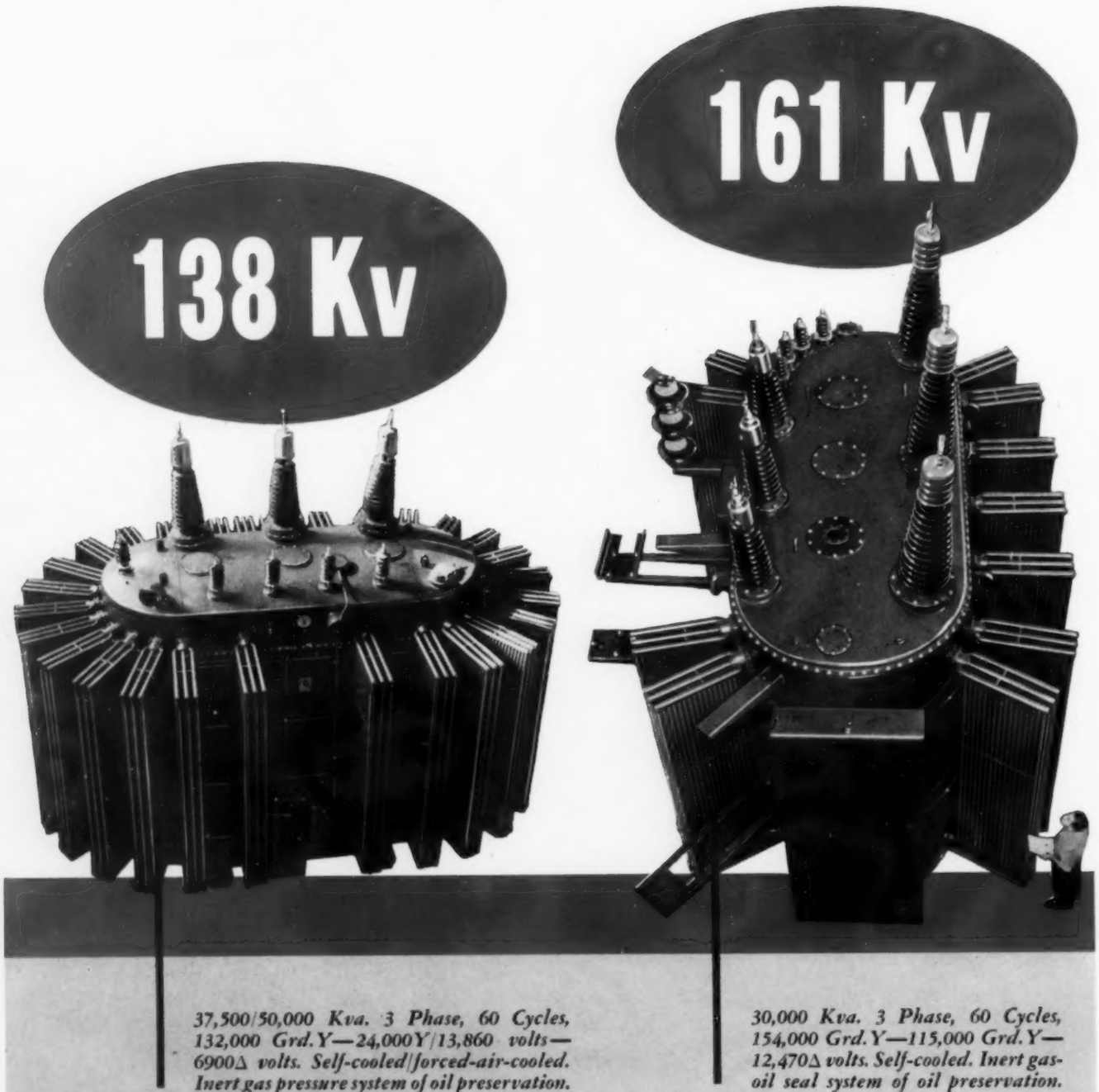
Palmoshield is by no means an "out-of-the-blue" discovery. It is a product of years of research prompted by the fact that World War II emphasized a definite threat to American steel producers dependent on overseas sources. More than that, it is backed by Ironsides' sixty years of specializing solely in the field of scientific lubrication.

Many steel men are familiar with other Ironsides "firsts," among them wax base drawing lubricants, aircraft cable lubricants, electro-deposition of drawing lubricants, outboard motor lubricants and stabilized non-ferrous wire drawing lubricants. It's significant that in any field it is the specialist who comes up first with the right answer to the tough problems. If yours is lubrication, consult the specialist—call on Ironsides first.

SPECIAL LUBRICANTS and PRESERVATIVES

IRONSIDES SHIELD PRODUCTS **PALMOSHIELD**

High Voltage POWER by Pennsylvania



37,500/50,000 Kva. 3 Phase, 60 Cycles, 132,000 Grd.Y—24,000Y/13,860 volts—6900Δ volts. Self-cooled/forced-air-cooled. Inert gas pressure system of oil preservation.

30,000 Kva. 3 Phase, 60 Cycles, 154,000 Grd.Y—115,000 Grd.Y—12,470Δ volts. Self-cooled. Inert gas-oil seal system of oil preservation.

TRANSFORMERS

Typical of the many higher voltage power transformers now under construction in the Pennsylvania plant are the recently-completed units pictured here. They represent single and three-phase transformers of core-form and shell-form construction.

Each transformer is designed and manufactured with the extra care and precision which will pay dividends to the user in the form of outstanding reliability and low operating costs.

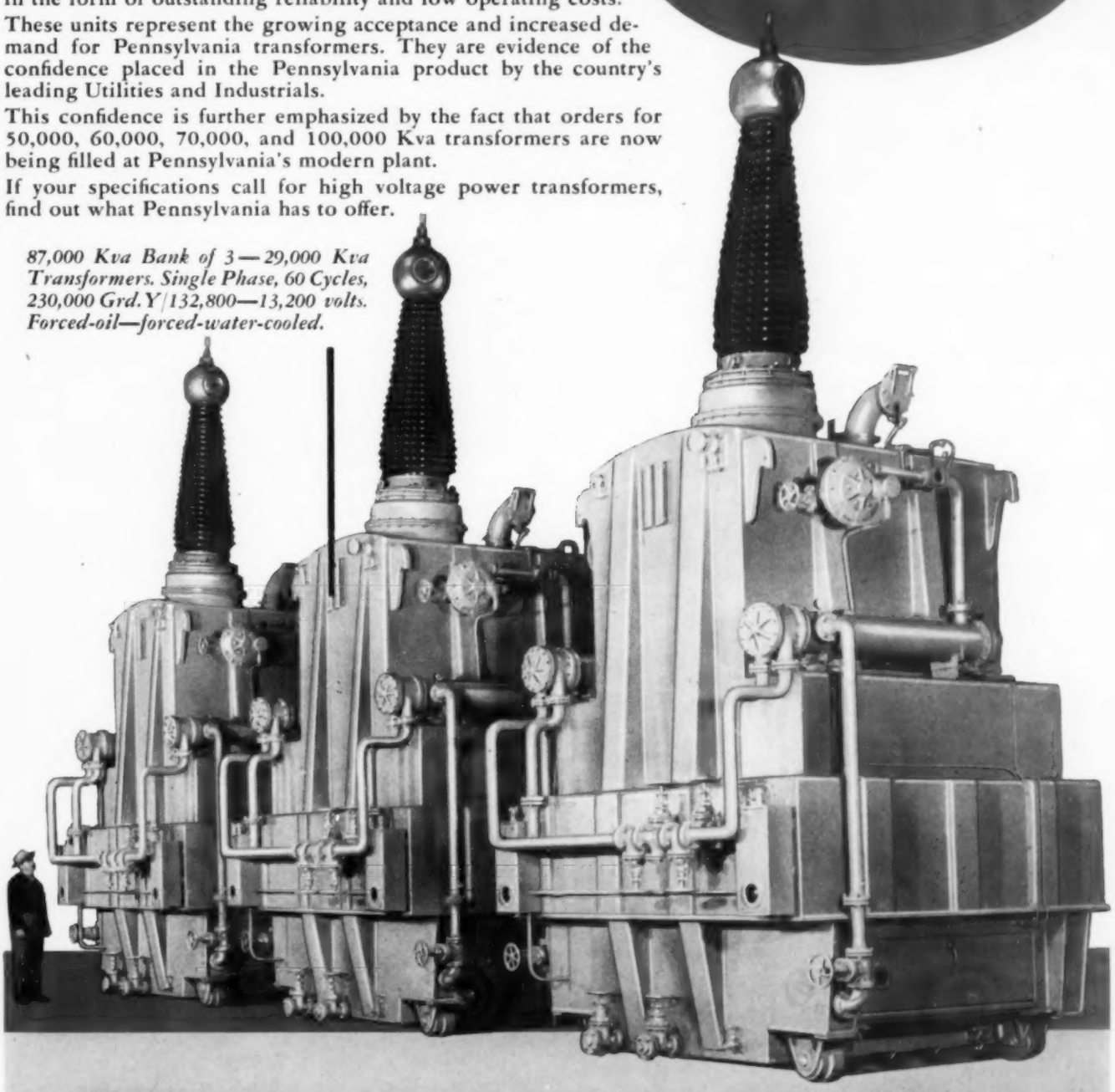
These units represent the growing acceptance and increased demand for Pennsylvania transformers. They are evidence of the confidence placed in the Pennsylvania product by the country's leading Utilities and Industrials.

This confidence is further emphasized by the fact that orders for 50,000, 60,000, 70,000, and 100,000 Kva transformers are now being filled at Pennsylvania's modern plant.

If your specifications call for high voltage power transformers, find out what Pennsylvania has to offer.

230 Kv

87,000 Kva Bank of 3—29,000 Kva Transformers. Single Phase, 60 Cycles, 230,000 Grd. Y/132,800—13,200 volts. Forced-oil—forced-water-cooled.



Pennsylvania TRANSFORMERS

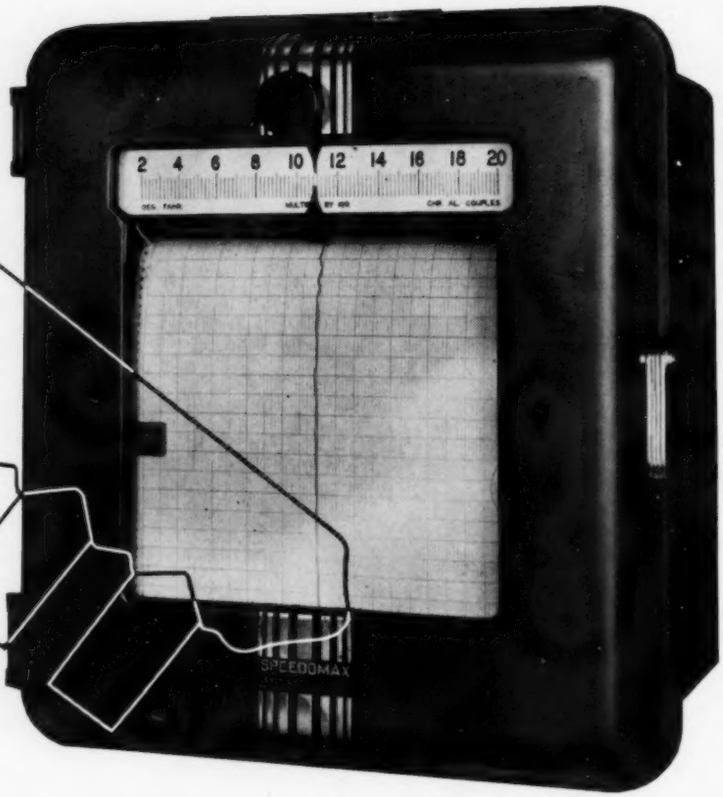
Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNA. • *Greater Pittsburgh District*

TEMPERATURE CONTROL

Matched to your plant's

FURNACE PRODUCT PRODUCTION



Need to get more work out of your furnaces and ovens? The pyrometer that fits the heating equipment, the product and the production need can do a great deal to turn out more tonnage, and also more that meets specifications.

Two Types of Control

The secret of successful automatic control is very simple; just turn the heat up and down in the particular way the furnace and product prefer. And there are only two general ways: On-Off Control, and Three-Function Control.

On-Off Control Can't "Think"

On-Off Control turns the fuel all the way up when temperature drops to a predetermined low point; turns it all the way down again at the specified high point. Temperature will of course undershoot and overshoot; when cycling is inside bounds, this simple control is very popular.

Three-Function Control Can "Think"

Instead of turning fuel up and down at preset limits, three-function control in effect, keeps looking at temperature trends. If they are trying to get out of hand, the Controller heads them off. This "thinking" is done in three ways:

1. Fuel is turned up and down in proportion to the furnace's heat change. (Function one)

2. If the furnace doesn't respond when the fuel is changed, the instrument waits a little—moves the valve again—keeps this up until the furnace does respond. (Function two)

3. If the temperature jumps, as when a heated charge is removed or a fresh charge put into a furnace, the speed of the resulting change can be considered by the Controller. (Function three)

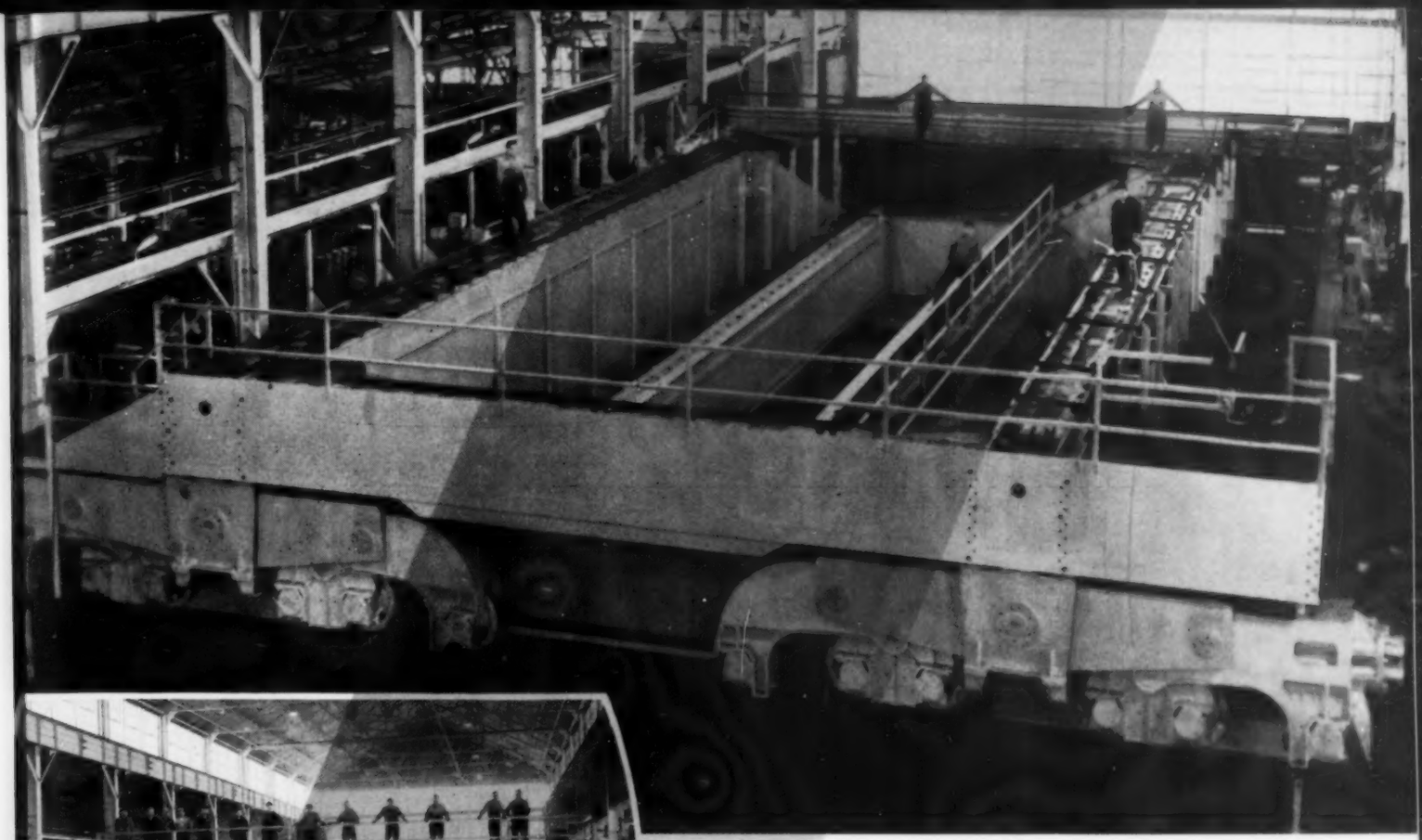
User Tunes the Control

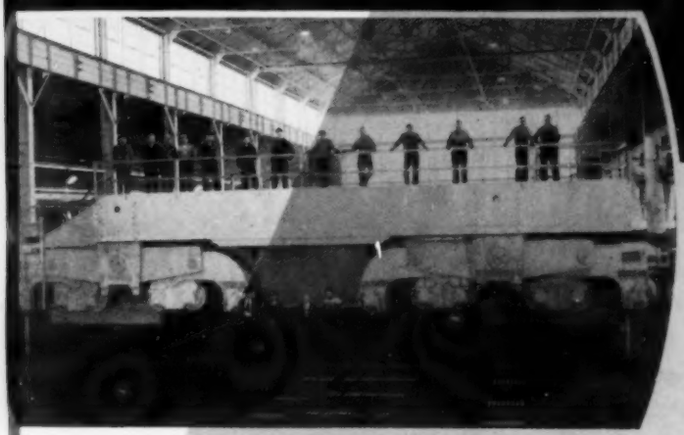
By turning dials on the control pyrometer, the user tunes the three functions to the process: he simply uses his common sense and experience. A big benefit is thus: that every furnace control can be tuned by the best-qualified man in the plant.

Further information on request; contact nearest L&N office or 4942 Stenton Ave., Phila. 44, Pa.

LEEDS LN NORTHRUP

Jrl. Ad. N-33(52a)





BRIDGE SPAN 76 FEET, OVERALL WIDTH 60 FEET

world's biggest ladle crane gets final inspection . . . . it's 350/60/25 TON ALLIANCE BUILT

● You're looking at two pictures of the world's largest ladle crane, shown, during final assembly, on the erection floor of the Alliance Machine Company.

This 350/60/25-ton, 4-girder, vibration-free giant will soon be helping one of the world's largest steel producers increase production capacity.

It's equipped with 24 track wheels on the bridge. The crane is so designed that each track wheel bears exactly 1/24th of the total load. And, like all Alliance Cranes, built for handling hot metals, raw materials, and finished products, it's safer, easier to operate and many times more efficient.

even bigger model now being built

The never-ending demand for bigger, better lifting power has kept Alliance on a constant path of research and development. For more than 50 years, Alliance has been the world's largest producer of the world's largest cranes.

Now in production are three 450-ton, 4-girder Alliance ladle cranes. These will be the largest ladle cranes ever built.

Let Alliance engineers help you with your heavy material handling problems. Write us today for an early consultation.

THE Alliance MACHINE COMPANY

World's largest builders of world's largest cranes

MAIN OFFICE
ALLIANCE, OHIO • PITTSBURGH OFFICE
1622 OLIVER BUILDING, PITTSBURGH, PA.

LADLE CRANES • GANTRY CRANES • FORGING MANIPULATORS • SOAKING PIT CRANES • STRIPPER CRANES • SLAB AND BILLET CHARGING MACHINES • OPEN HEARTH CHARGING MACHINES • SPECIAL MILL MACHINERY • STRUCTURAL FABRICATION

Case History No. 106
Rolling Mill Screwdown
9/10 LESS
Lubricant Used
THE I.P. LUBRICANT
with "Indestructible pH-ilm" capable of withstanding pressures up to 50,000 psi.

With BROOKS

LEADOLENE

On each eight hour shift in a large eastern steel plant 30 gallons of good quality steam cylinder oil were used on each of the two screws of a modern slabbing mill. Then LEADOLENE was thoroughly tested, and the tabulated results showed that only 3 gallons per eight hour shift were used on each screw . . . a savings of 9/10 on lubricant consumption. In addition, operating temperature of the screws was reduced from 210° F to 140° F.

On rolling mill screwdowns, the most difficult of all screws to lubricate, LEADOLENE consistently has reduced lubrication consumption and extended equipment service life. With its "Indestructible pH-ilm," plus high adhesiveness, exceptional temperature characteristics, and low pour point and viscosity, LEADOLENE gives superior service on all types of screws used to move apparatus . . . whether open or enclosed, horizontal, vertical, inclined, high or low speed.

Write for technical data or generous samples for your testing.

With LEADOLENE You Get These Characteristics Essential to Good Screwdown Lubrication

pH-ilm Strength . . . 50,000 psi minimum.

Adhesiveness . . . Affinity for metal develops maximum adhesion and reduces dripping and creeping.

Water Repellence . . . Effectiveness is not reduced by water.

Corrosion Prevention . . . Never acidic and will not etch or corrode.

Compounded Stability . . . Will not bleed or change physical condition within a greater temperature range.

Low Temperature Factors . . . Does not harden, crack or decrease in adhesion.

Abrasive Resistance . . . Repellent to adhesion of scale, metallics and other contamination.

The Brooks Oil Co.

Since 1876

Executive Offices and Plant . . . . . CLEVELAND, OHIO
Executive Sales Offices . . . . . PITTSBURGH, PA.
Canadian Offices and Plant . . . . . HAMILTON, ONTARIO
Cuban Office . . . . . SANTIAGO de CUBA

a compact, complete small mill. No cellars or elaborate foundations needed

TO meet the need of many manufacturers for a small, compact, inexpensive mill for the cold rolling of narrow, thin strip, UNITED developed, and is now offering, a NEW, COMPLETELY INTEGRATED "PACKAGE MILL."

Each unit is furnished fully equipped with roller bearing mounted rolls, recirculating rolling coolant system, mill guides, tension reels, belt wrappers if desired, strippers, motors and drives, all mounted on a fabricated base which serves also as a rolling coolant reservoir. The mill illustrated is a reversing type with motorized screwdown.

If a small, compact, completely self-contained "Package Mill" of this type fits into your present operations or contemplated expansion, consult us. Your inquiry will bring complete information at no obligation.

- **Mill can be equipped for one way rolling by using a simple coil box instead of a reel.**
- **Sleeve type or collapsing mandrels are optional with or without grippers to meet user's requirements.**
- **Hand screwdown can be furnished instead of motorized screwdown as shown.**

UNITED ENGINEERING AND FOUNDRY COMPANY

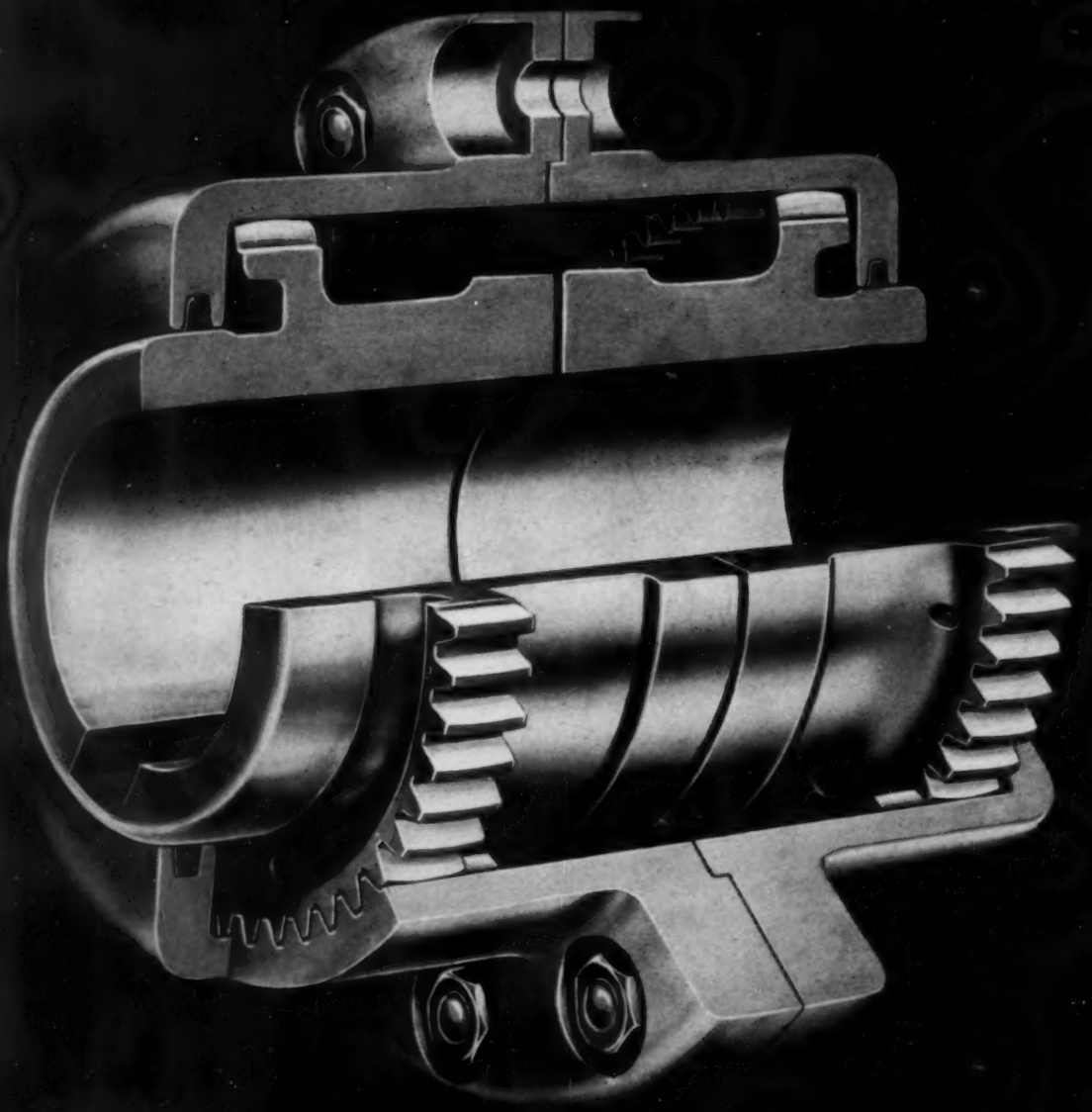
Pittsburgh, Pennsylvania

Plants at PITTSBURGH • VANDERGRIFT • NEW CASTLE • YOUNGSTOWN • CANTON

Subsidiaries: ADAMSON UNITED COMPANY, AKRON, OHIO • LOBDELL UNITED COMPANY, WILMINGTON, DELAWARE
STEDMAN FOUNDRY AND MACHINE CO., INC., AURORA, INDIANA

Designers and Builders of Ferrous and Non-Ferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other heavy machinery. Manufacturers of Iron, Nodular Iron and Steel Castings and Weldments.

POOLE

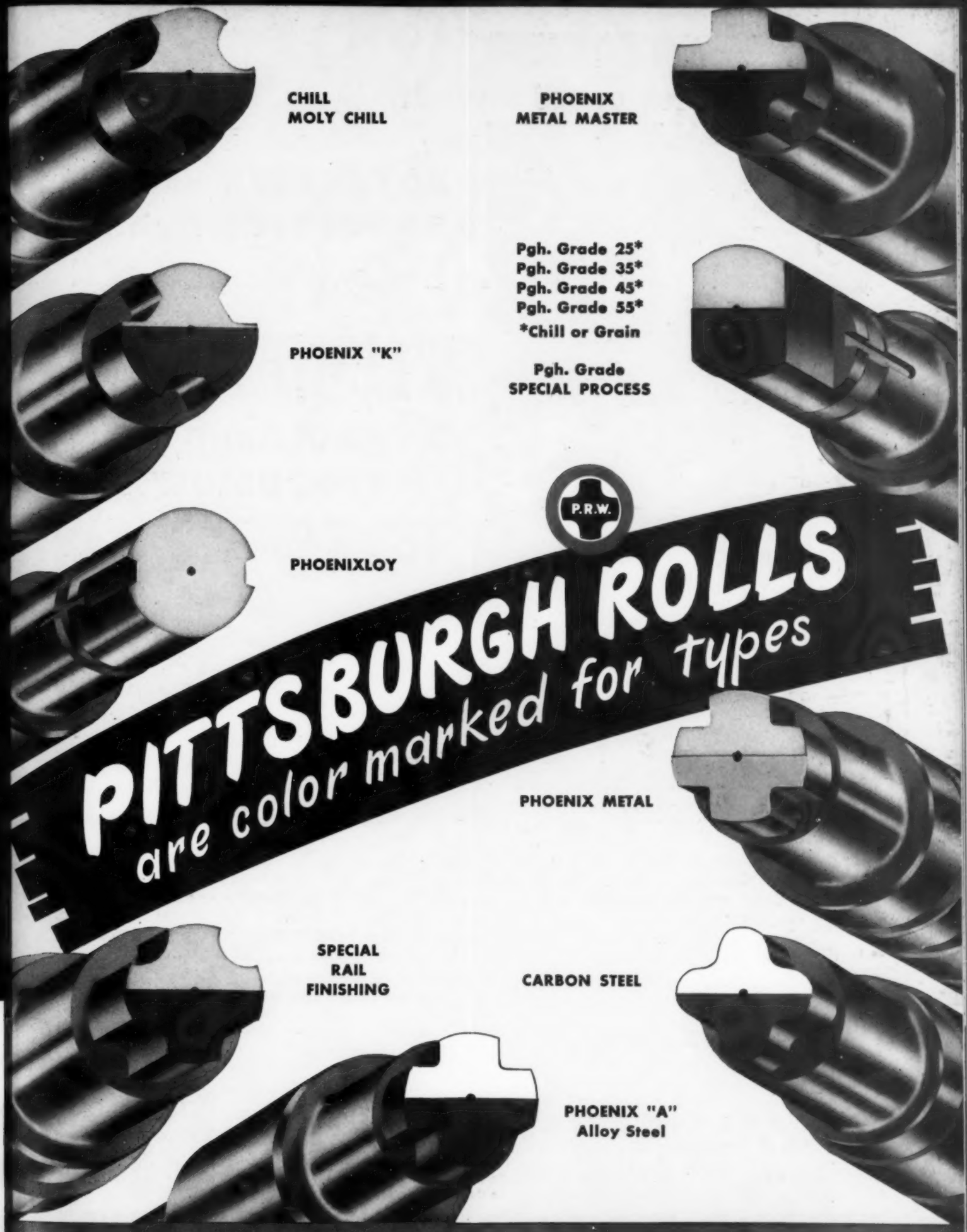


A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

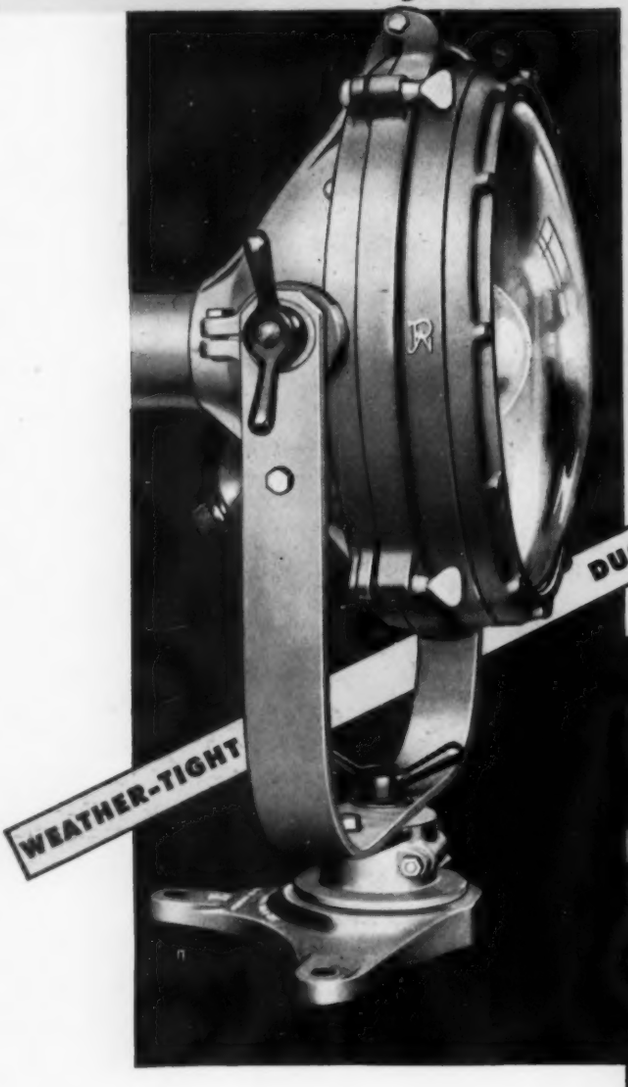
POOLE FOUNDRY & MACHINE COMPANY

WOODBERRY, BALTIMORE, MD.



PITTSBURGH ROLLS DIVISION of BLAW-KNOX COMPANY • PITTSBURGH, PA.

Consider the years ahead!

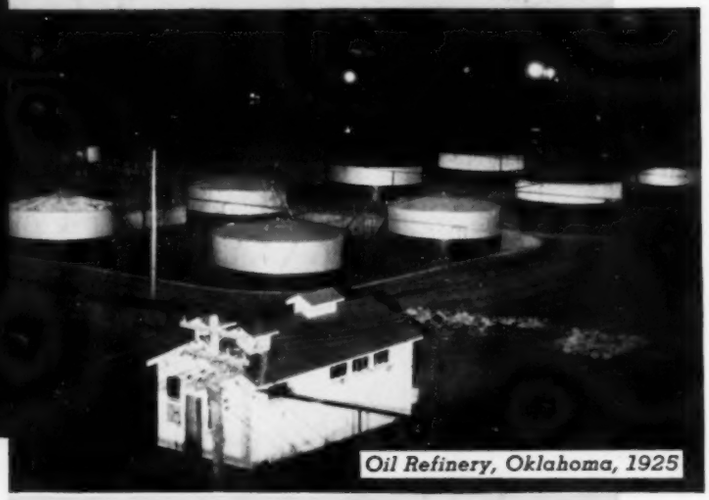


For PROTECTIVE and PRODUCTIVE lighting

Specify

PYLE-NATIONAL

ENCLOSED FLOODLIGHTS


Oil Refinery, Oklahoma, 1925

Don't economize on the initial cost when planning a floodlight installation. It is the elimination of large maintenance, repair and replacement expense that counts.

Sealed against moisture and dirt, constructed throughout of rugged, corrosion-proof materials, Pyle-National floodlights retain their original high-efficiency output throughout an exceptionally long service life, with negligible maintenance and replacement expense.

The earliest Pyle-National floodlighting installations are still operating in excellent condition, with *over a quarter of a century* of efficient, economical service to their credit! Convincing proof of the value of quality, enclosed floodlights.

Write for catalog 2100, which gives a complete description of our extensive line of heavy duty floodlights.

The services of our experienced floodlighting specialists are available at all times to advise and assist in installation problems.

THE PYLE-NATIONAL COMPANY

1383 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

District Offices and Representatives in Principal Cities of the United States
Export Department: International Railways Supply Co., 30 Church St., New York.
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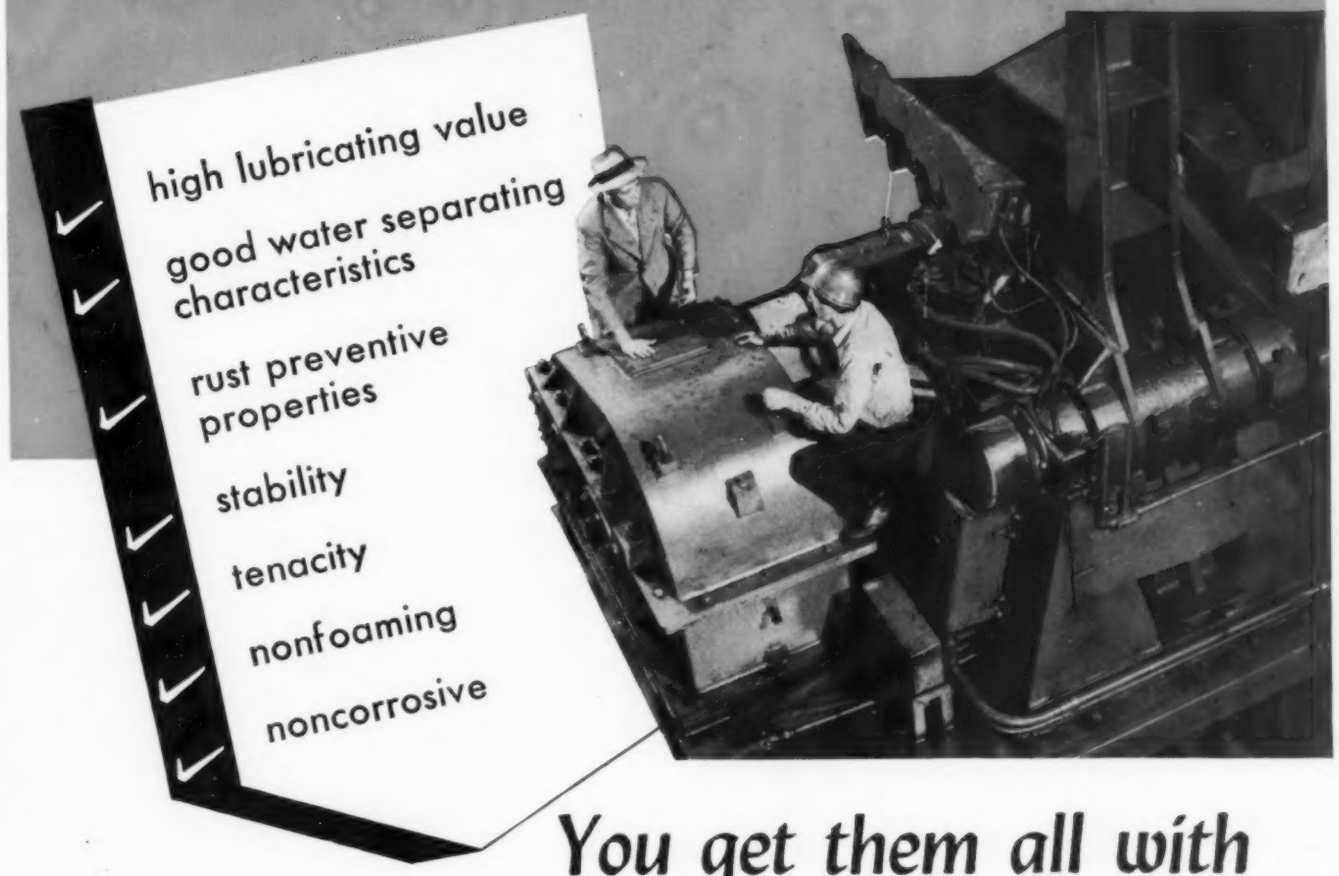
SINCE 1897

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • TURBO-GENERATORS • GYRALITES • MULTI-VENT AIR DISTRIBUTION

Properties that count in an extreme-pressure gear lubricant—



You get them all with

GULF E.P. LUBRICANTS

All the desirable properties of extreme pressure lubricants are combined in Gulf E. P. Lubricants to insure longer gear and bearing life, and lower maintenance costs for steel mill gear drives.

Gulf E. P. Lubricants are specially compounded to withstand the shock loads and high pressures encountered in the toughest service. They prevent metal-to-metal contact and excessive wear, keep maintenance costs low.

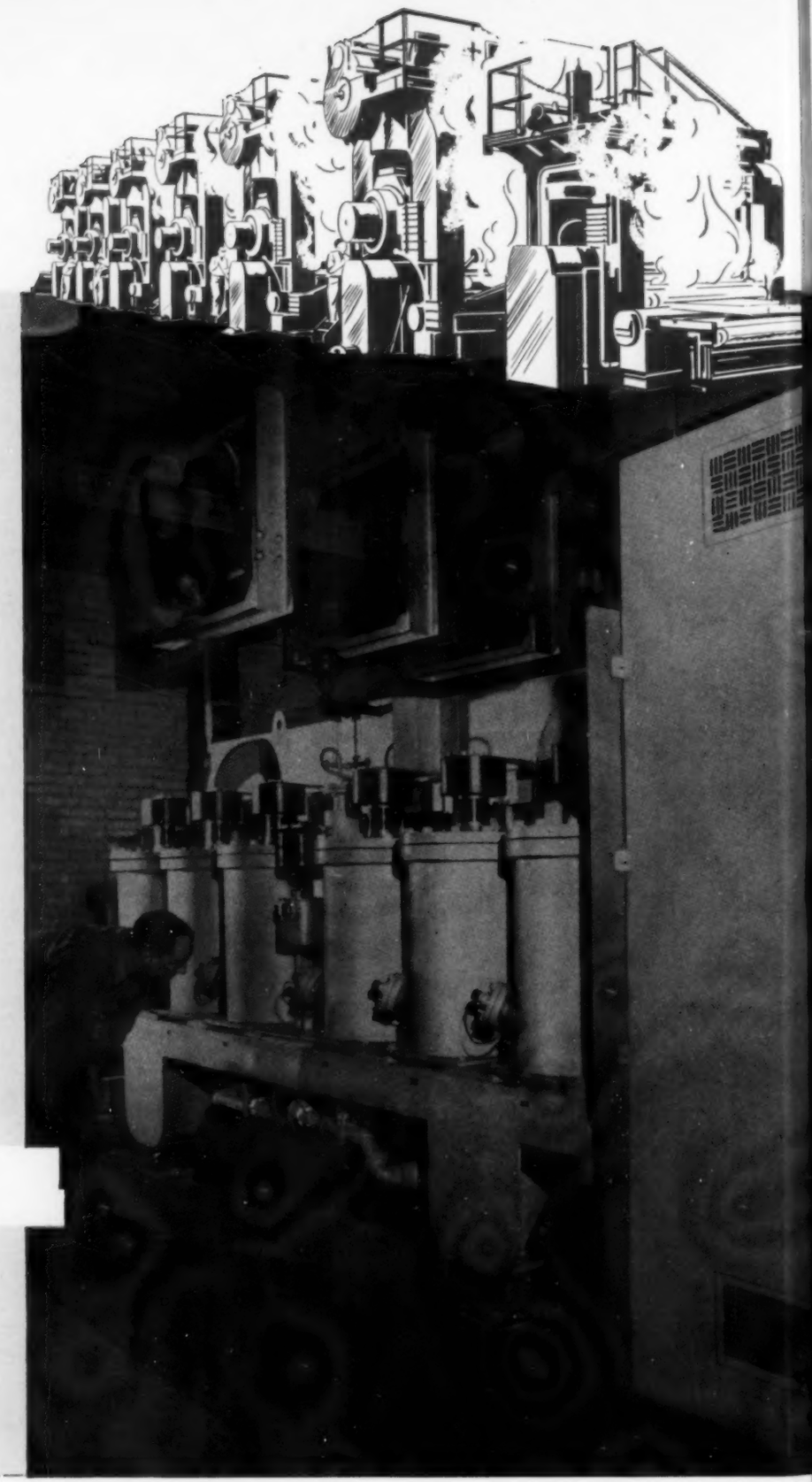
And they are outstanding in their ability to separate from water. When the proper grade is used and good maintenance practice is employed, most lubrication difficulties caused by water can be avoided.

Other advantages: nonfoaming—saves loss of lubricant and mopping up; tenacious—minimizes throwoff; extremely stable for this type of lubricant; help prevent rust; and they are just as suitable for the lubrication of all types of bearings.

Gulf E.P. Lubricants are available in the proper viscosity for every gear requirement, ranging from 55 to 1050 S.U.V. at 210°F. For specific recommendations for your equipment, call in a Gulf Lubrication Engineer today.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh 30, Pennsylvania

GULF INDUSTRIAL LUBRICATION



They did...

This Ignitron unit supplies a hot-strip mill in a big New York plant. When the mill was being planned, the company realized the advantages of the best power supply—in reduced costs, lower maintenance, and increased production.

what...

They called in Westinghouse early in their plans to get the benefit of Westinghouse experience in similar installations.

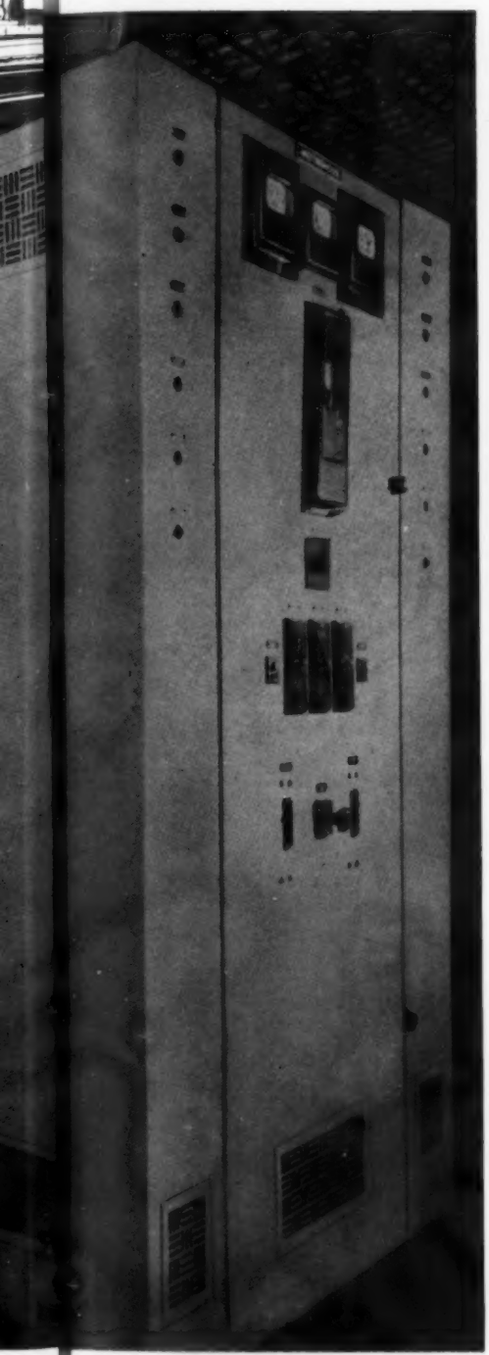
you can do...

Do what scores of other steel firms are doing. Have Westinghouse work with your engineers and machinery builders in applying equipment to your plant.

to produce more

Whether it's a new power system, a mill drive, better servicing, or a piece of electrical equipment to do a tough job ... Westinghouse has the answer.

Here's a new idea for your next rolling mill drive



Westinghouse Ignitrons are a new and proven power source for certain main mill drives. They cut the installed cost, the maintenance cost, and the power bills—for hot strip mills, merchant, rod and bar mills, seamless tube mills. Here's the record of the Ignitrons now in service.

Westinghouse Ignitrons cut costs, save power

Ignitrons cost less than M-G sets, need no special foundations, ventilation or alignment. But the big savings come after they're installed. Ignitrons are considerably more efficient than M-G sets. In the usual hot-strip mill the power saving is 600 kw. This amounts to $36,000 per year on a three-shift operation, figuring power at 1 cent per kwhr.

Excellent operating characteristics

From an operating standpoint, Ignitrons have thoroughly proven their practicality in this service. For starting, the d-c output voltage is reduced by "phase control". Turning a switch brings the mill to full operating speed. The Ignitrons normally supply all the power to the mill, but in two installations they operate in parallel with M-G sets.

Pumped tubes have longest life

Maintenance on Westinghouse Ignitrons averages two-thirds that of M-G sets. A big factor here is the long life of pumped Ignitron tubes. Gases are instantly sucked out by the vacuum system; they can't shorten tube life or necessitate factory overhauls. The vacuum system itself needs about three hours of maintenance once a year.

Call Westinghouse early on EVERY job

For more information about Ignitron rectifiers get in touch with your Westinghouse representative. And be sure to call in Westinghouse early whenever you're planning *any* new mill capacity. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-94881

YOU CAN BE SURE.. IF IT'S

Westinghouse

EQUIPMENT FOR STEEL PRODUCTION

A Complete Line of Motor and Generator Brushes and Contacts For Every Steel Mill Application

USG Industrial Brushes and Contacts are made in carbon, carbon-graphite, electro-graphitic, pure graphite and metal-graphite grades for alternating and direct current equipment of all kinds. They are made in production and replacement lots for either standard or special applications; many variations of the standard grades are also available in split type and solid form for the special applications.

Complete manufacturing facilities plus modern laboratory techniques help make USG Industrial Brushes and Contacts the best you can use in all types of rotating electrical equipment.

Write today for 40-page catalog giving complete information on standard USG grades.

90

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

FACT:

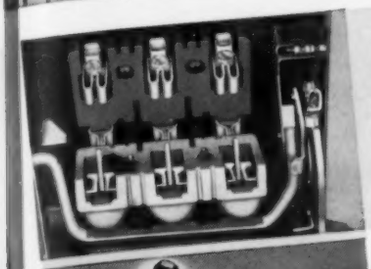
Square D Type A Safety Switches are the overwhelming first choice of industry

REASON:

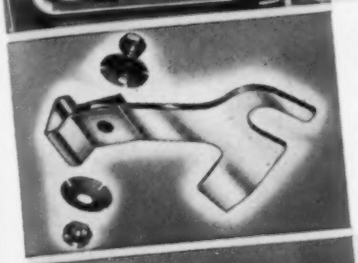
DESIGN LEADERSHIP

PROOF:

a feature-by-feature comparison

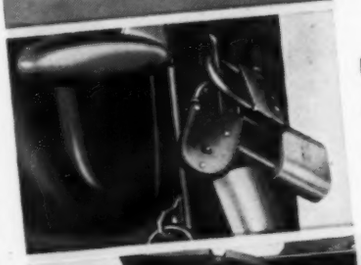


Magnetic Arc Suppressors "blow out" the arc, contribute to exceptionally high interrupting capacity.

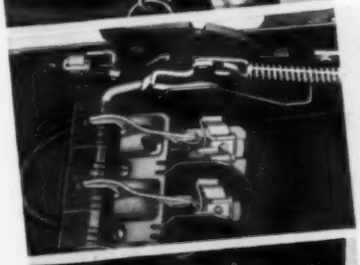


Spring-Loaded Blade Hinges for pressure contact. **Silver plated** current-carrying parts. Not flash plated but completely plated to reduce temperature rise.

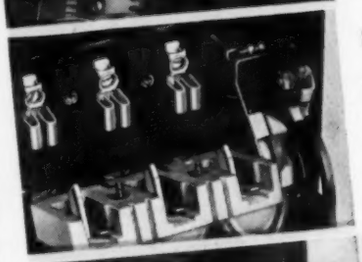
Positive Pressure Fuse Clips reduce heating at fuse contacts 60% or more.



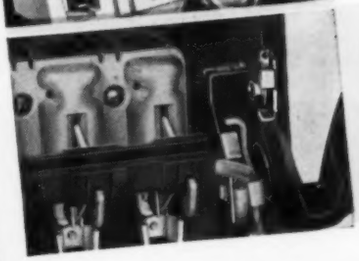
Padlock Attachment locks switch "ON" or "OFF" with 1, 2, 3 or 4 padlocks of virtually any shape or size.



True Quick-Make, Quick-Break Mechanism design makes it impossible to retard or to "tease" the operation.



Dead Front construction. All exposed parts are dead when switch is in "OFF" position. **Hinged Arc Barrier** makes it easy to reach line terminals.



Full Cover Interlock Switch cover can be opened or closed by authorized personnel without removing parts or interrupting service.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

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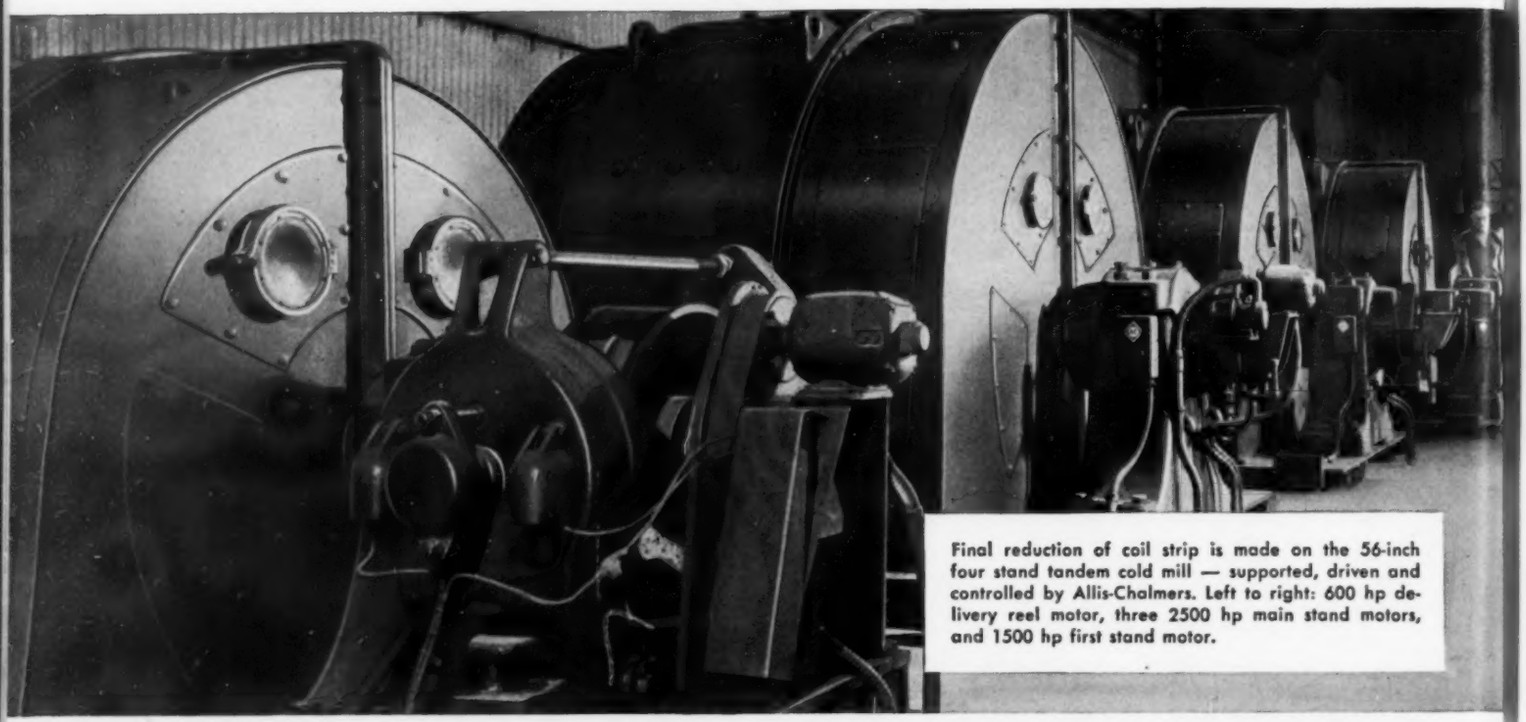
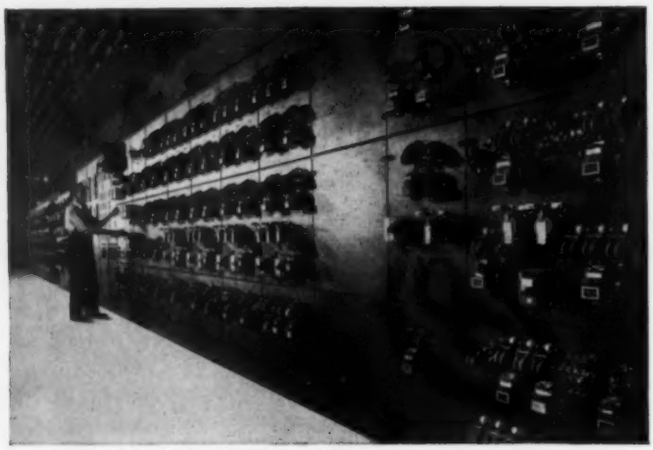
SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

ALLIS-CHALMERS SPEEDS

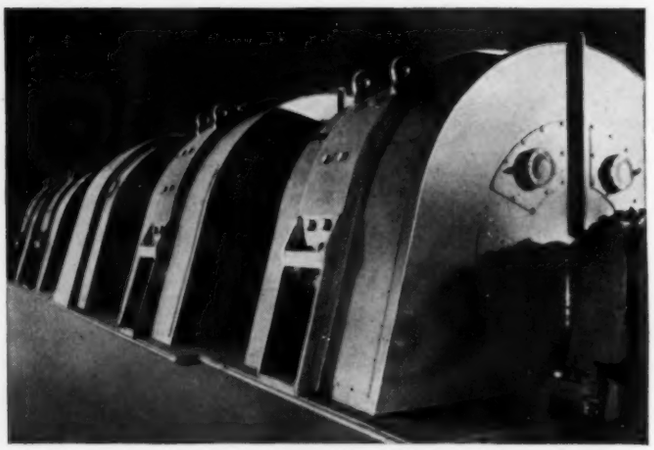


Final reduction of coil strip is made on the 56-inch four stand tandem cold mill — supported, driven and controlled by Allis-Chalmers. Left to right: 600 hp delivery reel motor, three 2500 hp main stand motors, and 1500 hp first stand motor.



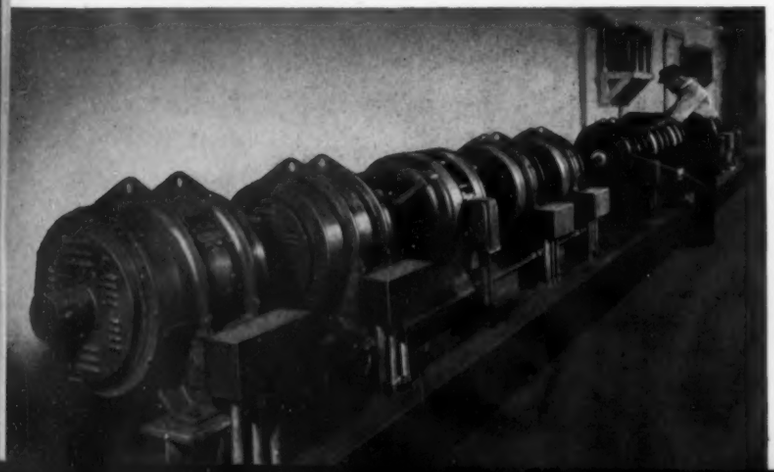
Variable voltage dc control board for 56-inch tandem cold mill. Allis-Chalmers supplied all controls and switchgear — as well as the main and auxiliary drives — for processing the steel from the hot mill to shipping.

Regulex rotating amplifier exciter sets provide variable voltage dc control of the drive motors and M-G set. Wide use is made here of *Regulex* exciter sets to control tension, reel buildup and speed matching.



The individual generator system of support and control is employed on the cold reduction mill, which was first placed in operation in 1947. The Allis-Chalmers supporting 7-machine, 7750 kw M-G set is seen here.

These three Allis-Chalmers 4000 kva oil immersed, self-cooled transformers handle the incoming power for the cold mill. Transmission power at 69 kv is transformed to 6900 volts for the synchronous M-G set.



SINCE
GRANITE CITY STEEL
1878

STEEL ROLLING

AN AGGRESSIVE, UNAFRAID APPROACH to increased demand is typical of the Granite City Steel Company. Completing a $26,000,000 expansion only two years ago, and with a $6,000,000 program nearing completion, the company now has announced a further $50,000,000 expansion! Capacity — mostly in coils, sheets and tinplate — will then be well over a million tons a year.

Operations pictured were included in the recently completed expansion. They illustrate the wide range of equipment Allis-Chalmers has supplied the Granite City Steel Company and offers to the American steel industry in its expansion efforts.

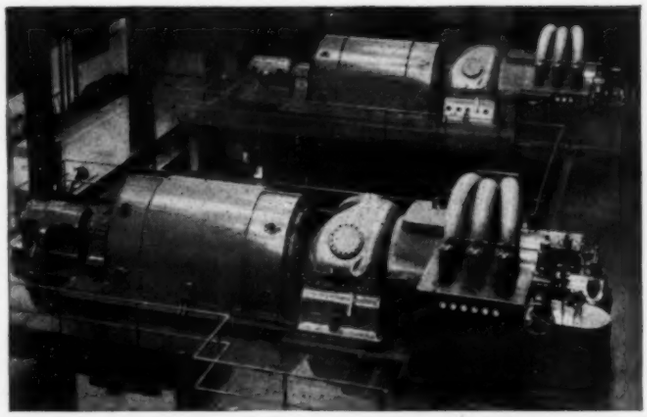
Complete electrical equipment — from the hot strip mill to shipping — was supplied by Allis-Chalmers! This broad, quality line of equipment has proved so satisfactory that the steel company has specified Allis-Chalmers substations and power transformers, as well as drives, controls and auxiliaries for the roughing and reversing blooming mills, for the *next* expansion program.

Constant growth has characterized this progressive midwestern company ever since its founding in 1878. During that time steel rolling at Granite City has gone from single stand, two high hand mills of under a ton per hour capacity to the modern four stand, four high tandem cold mill (left) of 45 tons per hour capacity.

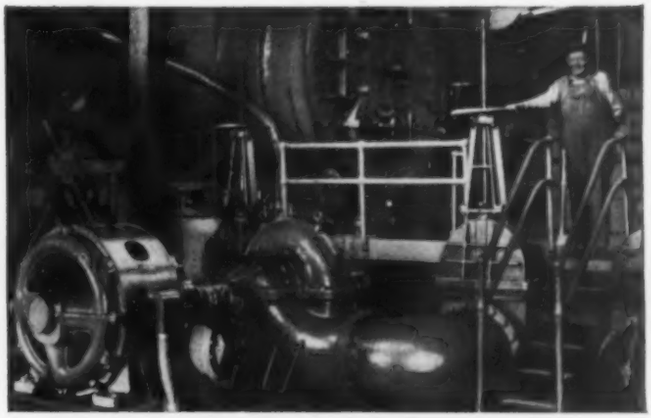
Strip is tempered (space not permitting illustration) on either a 48 or 56-inch temper mill . . . both of which are also Allis-Chalmers driven, supported and controlled. All electrical equipment for processing — including pickling, cleaning, tinning, and shearing — also is A-C supplied.

Your conversion or expansion program also can benefit from Allis-Chalmers wide experience in building and applying electrical equipment in the iron and steel industry. Integrated design and unit responsibility assure you of dependable performance. For more information, call the steel mill representative at your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3454



These two Allis-Chalmers 7500 kw condensing steam turbine generator units have been meeting the heavy power demand of the continuous hot trip mill at Granite City Steel Company for nearly 15 years.



At left above are the 8000 sq. ft. surface condenser, 11,300 gpm circulating water pump, and 150 hp induction motor — all Allis-Chalmers — serving one of the two 7500 kw steam turbines for the hot mill.

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Power, Electrical, Processing Equipment for Iron and Steel

Motor room for continuous hot strip finishing mill. Allis-Chalmers equipment supports, drives and controls the complete operation of this mill, including auxiliaries. Driving motors are seen at left, with two supporting 5000 kw synchronous M-G sets at right.

NOW Crane Collectors Last *MONTHS*... Instead of Weeks

KEYSTONE TYPE XVI

COLLECTORS CUT DOWN TIME, WORK STOPPAGE, AND COSTS

A large New Jersey corporation had a serious current collector replacement problem on its foundry crane. Ordinary collectors failed after one week's service! Production stopped, but furnaces still burned, as workers climbed up to make replacements.

Loss in production and labor time prompted the company to find a better current collector. Keystone Type XVI Collectors were recommended and installed. Now collectors *last months* before replacement is required! Production is up with a minimum loss of labor time.

Some Keystone Type XVI Collectors have lasted 25 times longer than ordinary collectors. Features include, inexpensive carbon contact easily removed by backing out two set screws. Large contact area is non-arcing, noiseless, self-cleaning and self-lubricating. Provides constant contact, longer life. Housing consists of two aluminum castings with large radiating fins to provide lower operating temperatures. For all sizes of trolley wires up to 4/0 incl.

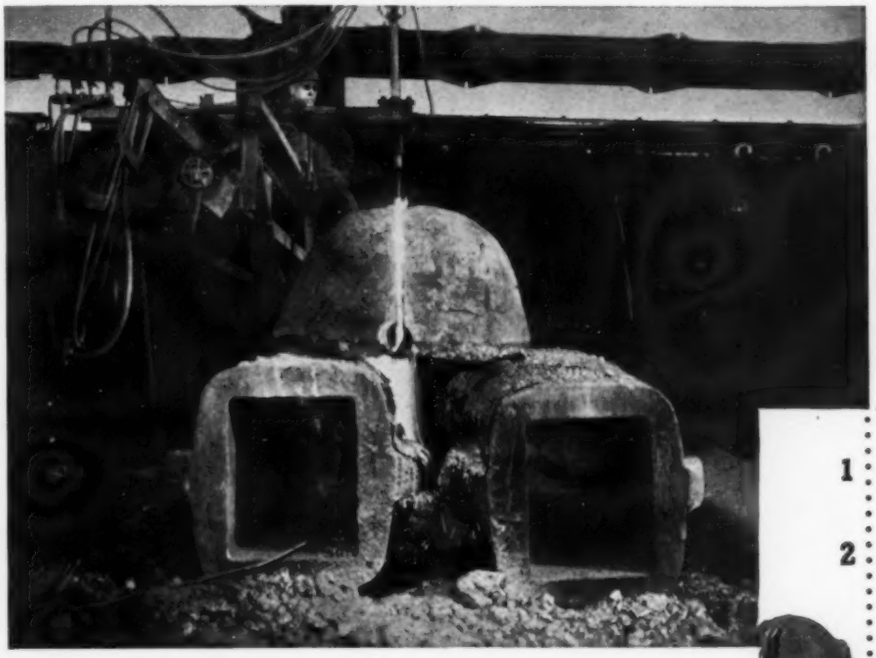
If you have a similar current collecting problem in your plant, find out about Keystone Type XVI Collectors. Write us today for latest, illustrated folder on Keystone electrical products.

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PENNA.

Manufacturers of complete line of insulator supports for rail and wire conductors and current collection devices.

Heavy Scrap Cutting jumped from 150 to 500 tons per month . . .



WITH COSTS CUT TO THE BONE

1 An AIRCO NO. 41 RADIAGRAPH cuts a button to charging box size in fifteen minutes.

2 Finished cut, showing steel and cast iron sections cut to charging box size.

A large eastern steel mill was cutting only 150 tons of heavy scrap per month with the torch and lance method of reduction . . . and not all of it could be cut to charging box size. Therefore, it was necessary to wait until the open-hearth furnaces were rebuilt to charge the oversize pieces—a costly and time-consuming process.

Airco Technical Representatives, with long experience in the machine cutting field, suggested a way to expedite heavy scrap cutting, and bring it up to present demand. An Airco No. 41 Radiagraph gas cutting machine, fitted with an Airco Style 6740 torch and Style 174 cutting tip, was installed. Now the mill averages 500 tons of heavy scrap per month—*all of it cut to charging box size.* This tremendous production rate has resulted in major savings for the mill . . . savings of time, trouble and money.

You, too, may be able to utilize Airco's Technical Sales Service to help you cut costs . . . speed production. Their extremely broad knowledge may help solve your metal-working problem. Write your local Airco office for complete information.

AIRCO

AIR REDUCTION

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY
AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
Divisions of Air Reduction Company, Incorporated
Dealers and Offices in Principal Cities

MACK-HEMP

guideless rotary straighteners

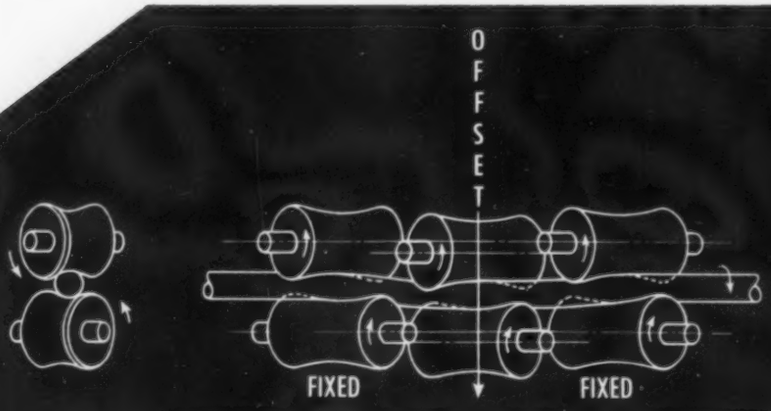
FOR

production-line straightening and finishing

OF

metal tubing and pipe

1/16" O. D. TO 15" O. D.



The Mackintosh-Hemphill method of straightening is accomplished by an offset cross-roll pass between two fixed cross-roll passes (patented). No guides are required because the rolls are driven on both sides of the stock which is supported by the bottom rolls. With this balanced arrangement there is no decreasing efficiency from uneven wearing of the rolls. The straightening takes place from section to section and not from point to point.

These modern productioneering tools straighten and finish cut-length material such as stainless instrument tubing, aluminum aerial stock, copper fuel lines, aviation brake tubing, standard welded pipe, heavy-wall seamless alloy tubes, large diameter wrought-iron pipe, and many other ferrous and non-ferrous tubular products *in sizes ranging from 1/16" O.D. to 15" O.D.*

Mack-Hemp Rotary Straighteners employ a six-roll arrangement, basic in all sizes, which

- **STRAIGHTENS to precision tolerances, end-to-end**
- **FINISHES without leaving spiral scores, cuts, or rub marks on exterior surfaces**
- **REMOVES end bends from cut-length stock**
- **SPEEDS straightening and surface finishing operations**

Mackintosh-Hemphill Rotary Straighteners employ a patented roll arrangement with an offset cross-roll pass between two fixed cross-roll passes.

This feature eliminates supporting guides for the material and increases the productive life of the rolls.

Send for bulletin S-7265 which describes in detail, the Mack-Hemp Rotary Straightener.

MODEL AYZ MACK-HEMP ROTARY STRAIGHTENER. NOTE CIGARETTE LIGHTER AT LOWER LEFT.

MACKINTOSH-HEMPHILL

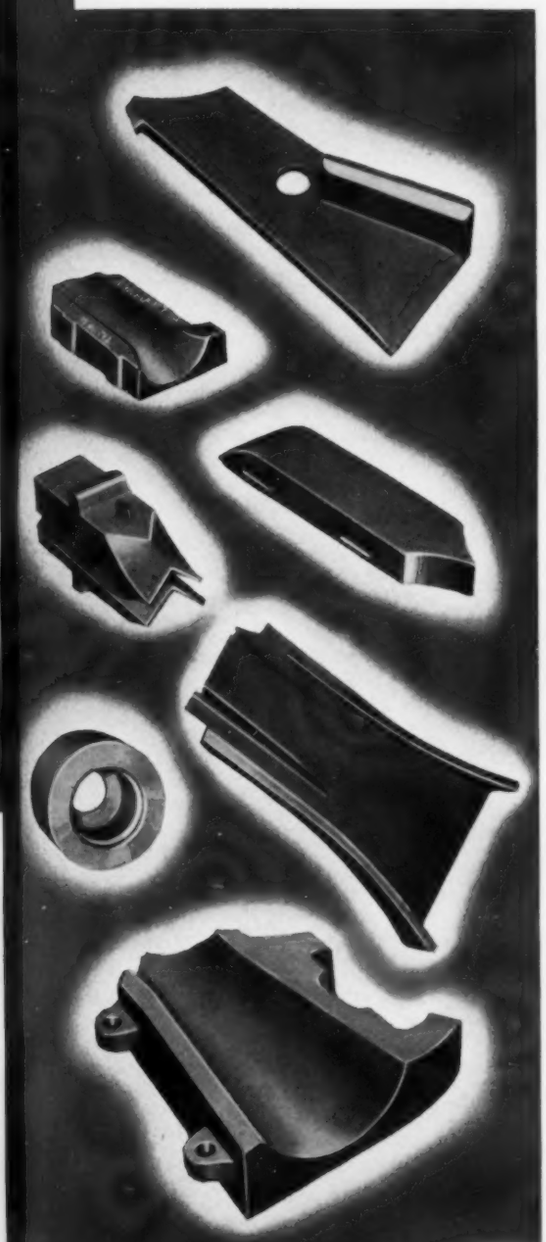
COMPANY

PITTSBURGH and MIDLAND, PENNSYLVANIA

MACKINTOSH-HEMPHILL PRODUCTS INCLUDE: **ROLLS . . . STEEL AND SPECIAL ALLOY CASTINGS . . . COMPLETELY INTEGRATED STRIP MILLS . . . HEAVY DUTY ENGINE LATHES . . . MACKINTOSH-HEMPHILL ROTARY STRAIGHTENERS . . . IMPROVED JOHNSTON PATENTED CORRUGATED CINDER POTS AND SLAG-HANDLING EQUIPMENT . . . SHAPE STRAIGHTENERS . . . END-THRUST BEARINGS . . . SHEARS . . . LEVELLERS**

trantinyl

guides the steel industry



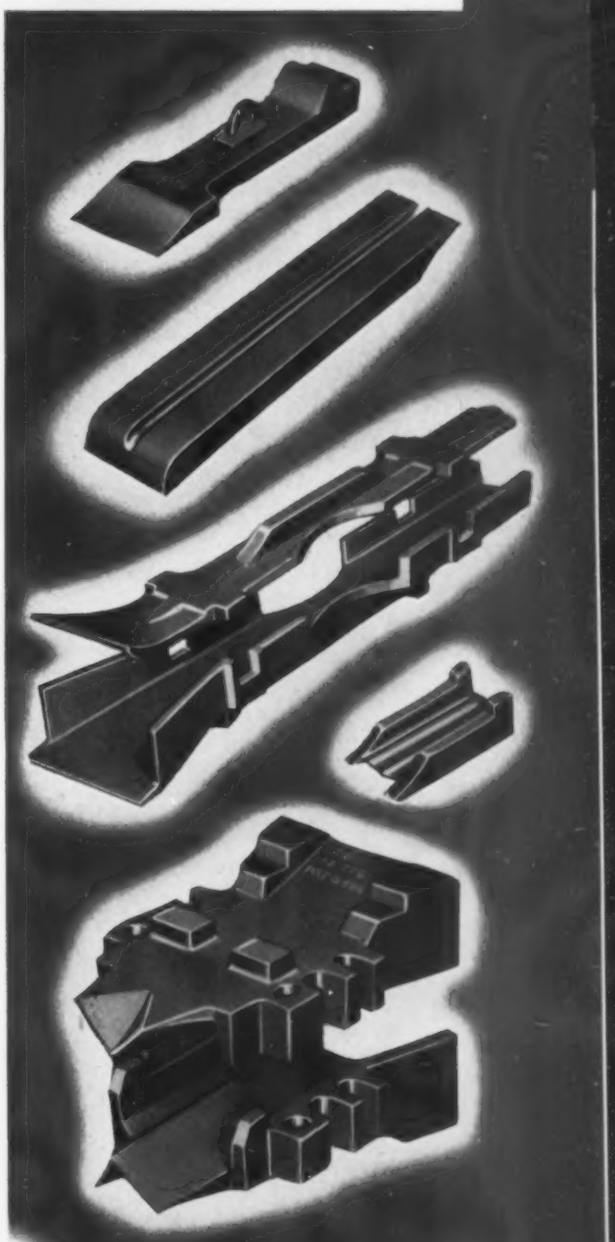
ROLLING MILLS:
bar, hoop, strip, shape
mill guides; and rollers

SEAMLESS TUBE MILLS:
guide shoes, rolling
mill plugs and rolls,
piercer points, etc.

ELECTRIC WELD TUBE MILL:
forming rolls, planishing
rolls, tool holders, etc.

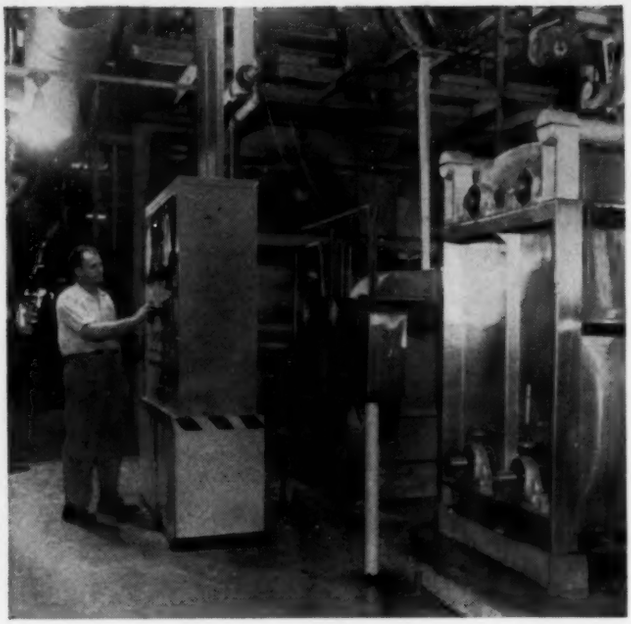
STRAIGHTENING MACHINE GUIDES

HEAT RESISTING CASTINGS



YOUNGSTOWN ALLOY CASTING CORP. • YOUNGSTOWN, OHIO

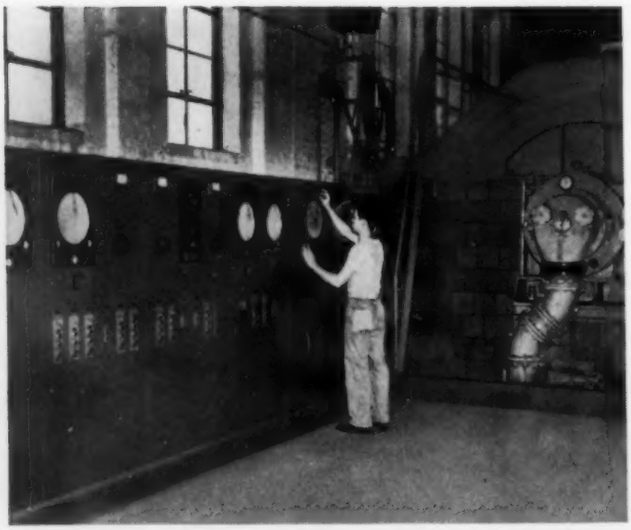
HOT DIP *tin house in large eastern steel mill uses ElectroniK instruments to control metal and palm oil temperatures . . . in adjacent departments, the same instruments control huge electrolytic tin lines, insuring quality tinplate and minimum use of the strategic metal.*



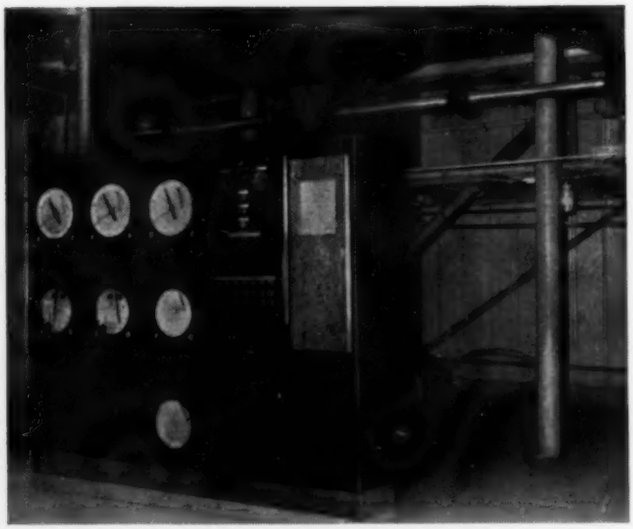
COORDINATION *of speeds, temperatures, pressures, flows and other variables . . . through modern instrumentation . . . makes possible the stabilization of continuous textile bleaching, and results in greater overall production in such a modern installation as this.*

For all of industry . . . *especially*

Instruments



ONE MAN BLEACH PLANT, *with the best equipment and controls, produces 130 tons of bleached pulp per day. The plant runs so smoothly that the operator also has time to make hourly tests on bleach liquor and bleached pulp.*



CITRUS CONCENTRATORS *at Pasco Packing Company plant turn out 1250 gallons of high quality concentrate per hour. One man supervises operations . . . aided by Honeywell automatic control system which regulates raw juice flow, heat input, and density of finished product.*

BATTERY OF SOAKING PITS *handles mass production of treated ingots, with the help of modern instruments . . . used to maintain pit temperature, bring ingots to proper heat, and insure uniformity. They automatically compensate for load changes, shut off fuel when pits are open, fire again when pits are closed.*

for the metals industry

speed production

FROM HUGE sprawling plants to back-yard shops, the great and growing metals industries are ever ready to meet the multiplied demands of a national economy thirsty for more metal and more metal products. And tops on the list of production tools are the instruments and controls that coordinate and stabilize such critical variables as temperature, pressure, flow and pH.

Modern metal producing and processing couldn't approach the production records now established . . . only to be bettered tomorrow . . . without the aid of industrial instrumentation. The scattered machinery, of tremendous size and unparalleled complexity . . . plus the ever stricter quality specifications . . . demand continuous precision and accuracy available only from instruments and controls which can keep pace with process requirements.

Brown instruments and controls, of course, have been playing a vital role in such production operations for many years . . . and, just as in research and development, will continue to meet the demands of new techniques and new equipment.

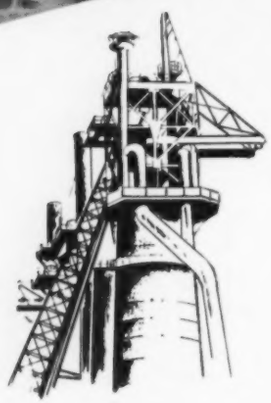
Our local representative will welcome the opportunity to discuss your instrumentation requirements . . . for any operation. Call him in today, he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4464 Wayne Ave., Philadelphia 44, Penna.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

● *Important Reference Data*

Write for a copy of new brochure, "Tomorrow Is Today"... for a brief description of the manifold contributions of instruments to industrial processing.



EC&M Skip-Hoist Controller Helps Speed Round-the-clock Charging

Expected furnace capacity at the time of construction was 1250 tons per day or 38,750 tons a month. A recent month's output was over 50,000 tons (nearly 30% above the planned capacity). Contributing to increased output is the high speed operation of this skip-hoist made possible by the many advantages found in the EC&M Rheostatic Method of Control. These are:

1 **Adjustable control**—allowing up to double the running speed on the straight part of the track for reduced charging time. Full field strength and maximum torque for acceleration, and at slow down for accurate stopping—either with an empty bucket or capacity ore load.

2 **Low initial investment**—and low standby renewal part inventory.

3 **Simple construction**—easily inspected with minimum labor and upkeep expense.

4 **Safe, smooth operation** under all conditions of stone, coke or ore loads.

Consult with EC&M, without obligation, when considering control for blast furnace distributor-tops, bell-hoists, skip- hoists, etc.

NO DELAYS IN 8 YEARS

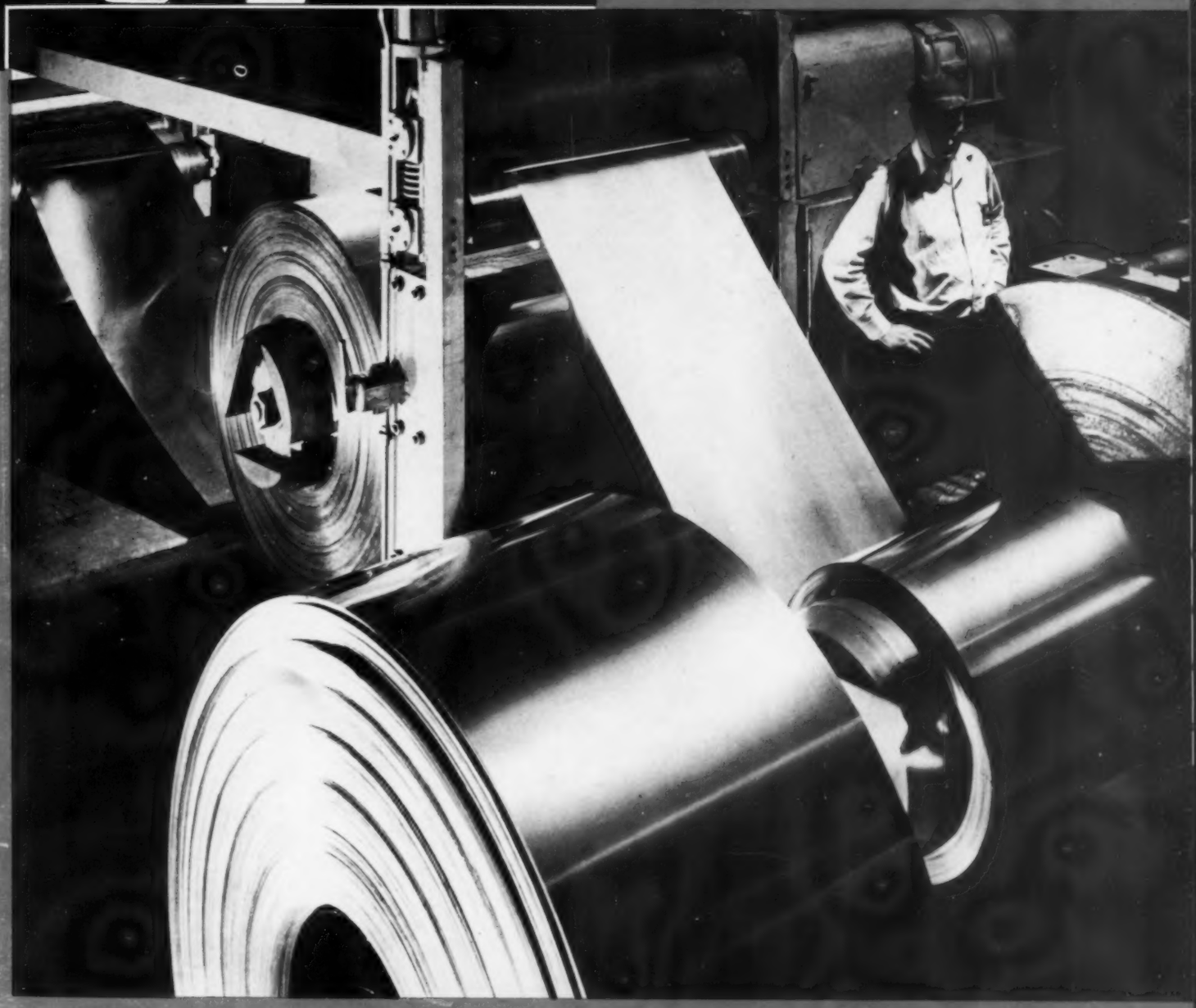
This is but one of several blast furnace skip-hoists used by this large steel maker and equipped with EC&M LINE-ARC Contactor Control. EC&M has recently built additional controllers for two new blast furnace skips for this company.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

WEAN

ENGINEERING Company, Inc.

WARREN, OHIO



The Wean Engineering Company, Inc., Warren, Ohio is a recognized specialist in the design and installation of sheet, tin and strip mill equipment. The expert knowledge and trained imagination of one of the world's most noted steel mill engineering firms is at your service when you specify Wean—whether the job calls for a single piece of equipment or a complete design of an entire line.

SPECIALISTS IN SHEET, TIN and STRIP MILL EQUIPMENT

Solving industry's toughest problems has been the business of the Wean organization for more than 20 years. The photograph on this page is a typical example of Wean technical skill. The two giant machines—recently featured in *Colliers Magazine* as an industrial triumph—were completely engineered and built by the Wean Equipment Corporation to expedite the construction of Army tanks. They were built to grind and drill a special surface on the tough armor plate. They do the jobs 22 times faster than any previously known method.

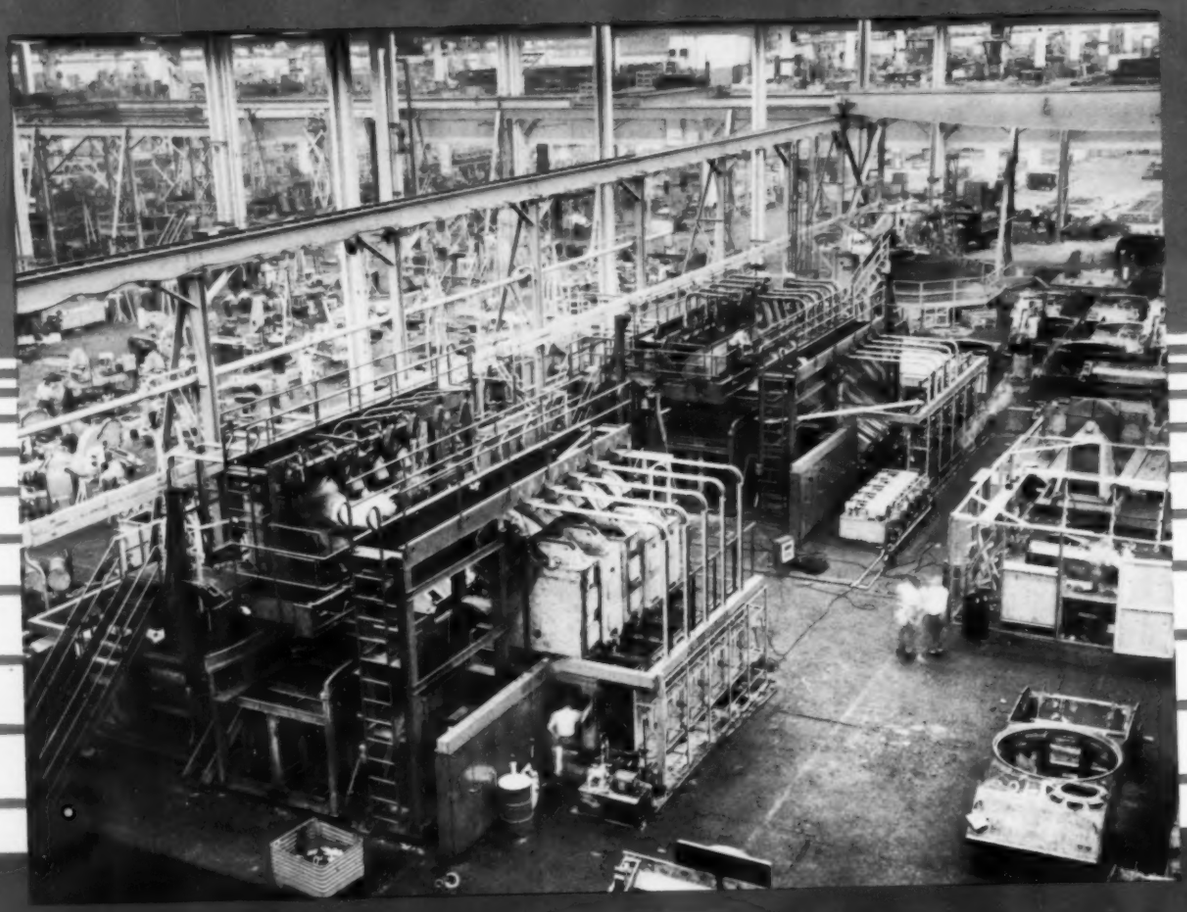
When you have a job that requires special machinery—large or small—you'll be wise to call in a Wean engineer.

WEAN STRIP MACHINERY

SLITTING LINES • SHEARING LINES
BI-METAL COATING LINES • LEVELING MACHINERY
UNCOILING AND RECOILING EQUIPMENT
TRANSFER MACHINING EQUIPMENT
SPECIAL MACHINERY

WEAN WIRE MILL EQUIPMENT

FENCING MACHINERY
WIRE GALVANIZING LINES
BARBED WIRE MACHINERY



Wean EQUIPMENT *Corporation*

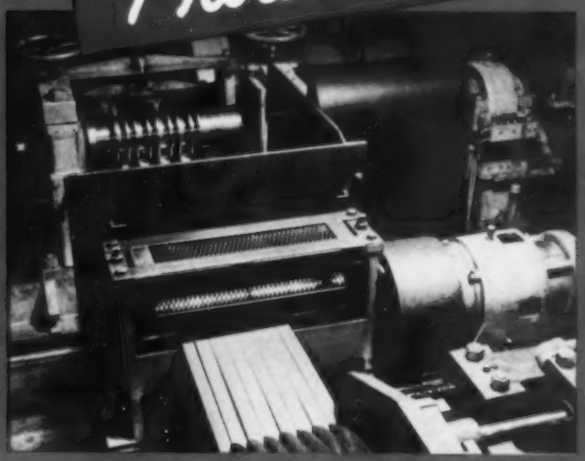
CLEVELAND, OHIO

Strip Machinery

Process

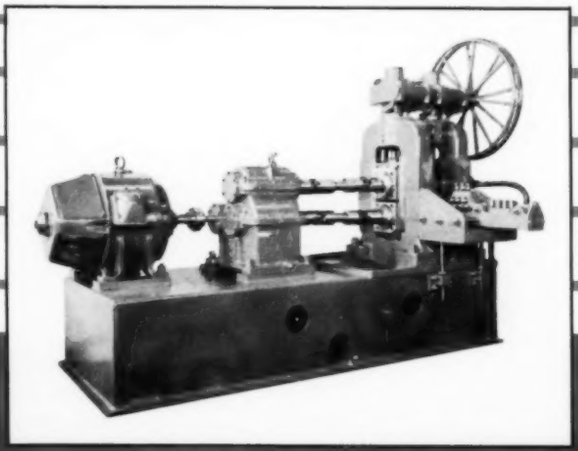
Synchronized Automatic Sheer Lines

Product

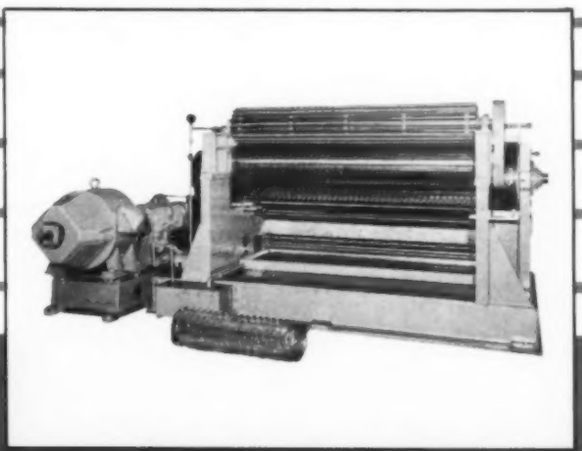


Slitting Lines

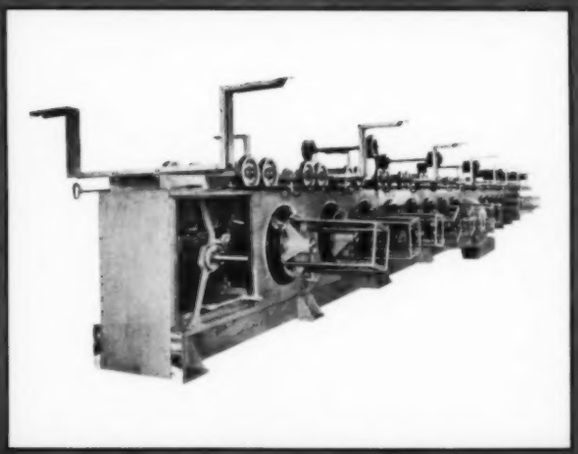
Wire Machinery



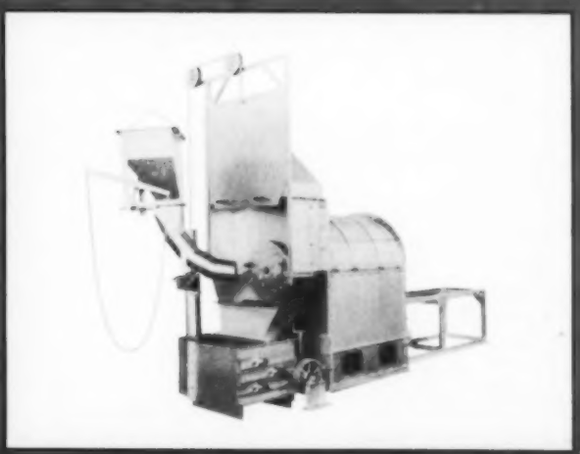
2-Hi Wire Flattening Mill



Hexagon Netting Machine



Wire Galvanizing Take-Up Frame



Nail Galvanizing Unit

Continuous Strip Pickle Line

Continuous Electrolytic Cleaning Line

WEAN ENGINEERING Company, Inc.

WARREN, OHIO

Continuous Coating Line

Tin Plate Shearing Line

Associate Companies . .

WEAN EQUIPMENT CORPORATION . . . . . Cleveland, Ohio
THE McKAY MACHINE COMPANY . . . . . Youngstown, Ohio
FLINN & DREFFEIN ENGINEERING CO. . . . . Chicago, Illinois
THE HALLDEN MACHINE COMPANY . Thomaston, Connecticut
THE DREVER COMPANY . . . . . Philadelphia, Pennsylvania
THE WEAN ENGINEERING CO. of CANADA, Ltd., Hamilton, Ont.

Representatives . .

ENGLAND
JOHN MILES & PARTNER (London, Ltd.)
London, England

FRANCE
P. DAMIRON & COMPANY
Paris, France

ITALY
NORVIL COMPANY
Milan, Italy

SPECIALISTS IN SHEET, TIN and STRIP MILL EQUIPMENT

Faster Heating Pits

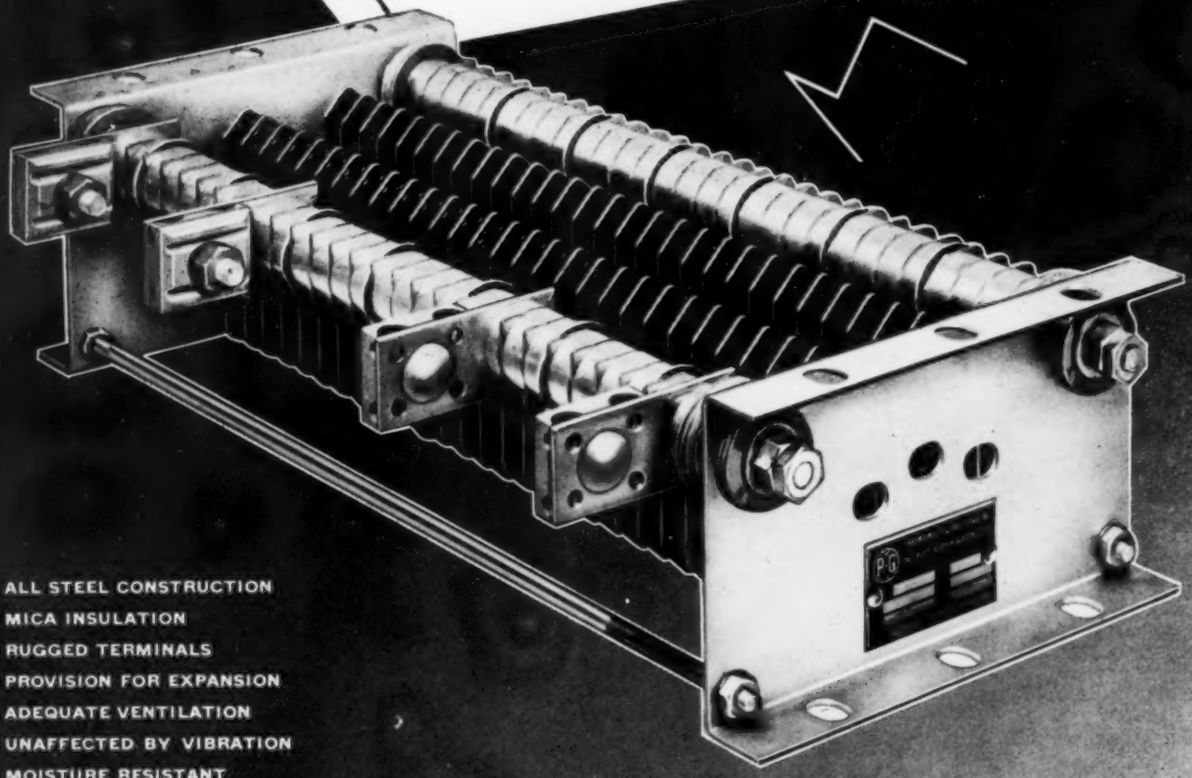
Typical of Salem-Brosius' leadership in service to the metal-working industry are the highly efficient ingot heating pits built by the Salem Engineering Division. These pit-type furnaces are well-known for rapid, uniform and accurate heating, easy operation, economy, great durability, and reduced scale loss. If you have a problem which involves the use of heating furnaces, blast furnace equipment, or charging and manipulating machines, it will pay you to call on highly experienced and diversified Salem-Brosius today.

SALEM-BROSIUS, INC.

SALEM ENGINEERING DIVISION, SALEM, OHIO

BROSIUS DIVISION, PITTSBURGH 15, PA.

DURABILITY
the first essential



★ ALL STEEL CONSTRUCTION
★ MICA INSULATION
★ RUGGED TERMINALS
★ PROVISION FOR EXPANSION
★ ADEQUATE VENTILATION
★ UNAFFECTED BY VIBRATION
★ MOISTURE RESISTANT
★ CORROSION PROTECTED

Steel and Mica, the two basic materials entering the construction of P-G Steel Grid Resistors, are the foundation for longer resistor service. P-G uses these materials in a unique design to provide both for expansion and for maximum ventilation. For more detailed information, ask for a copy of Bulletin No. 500 . . . . . .

P-G

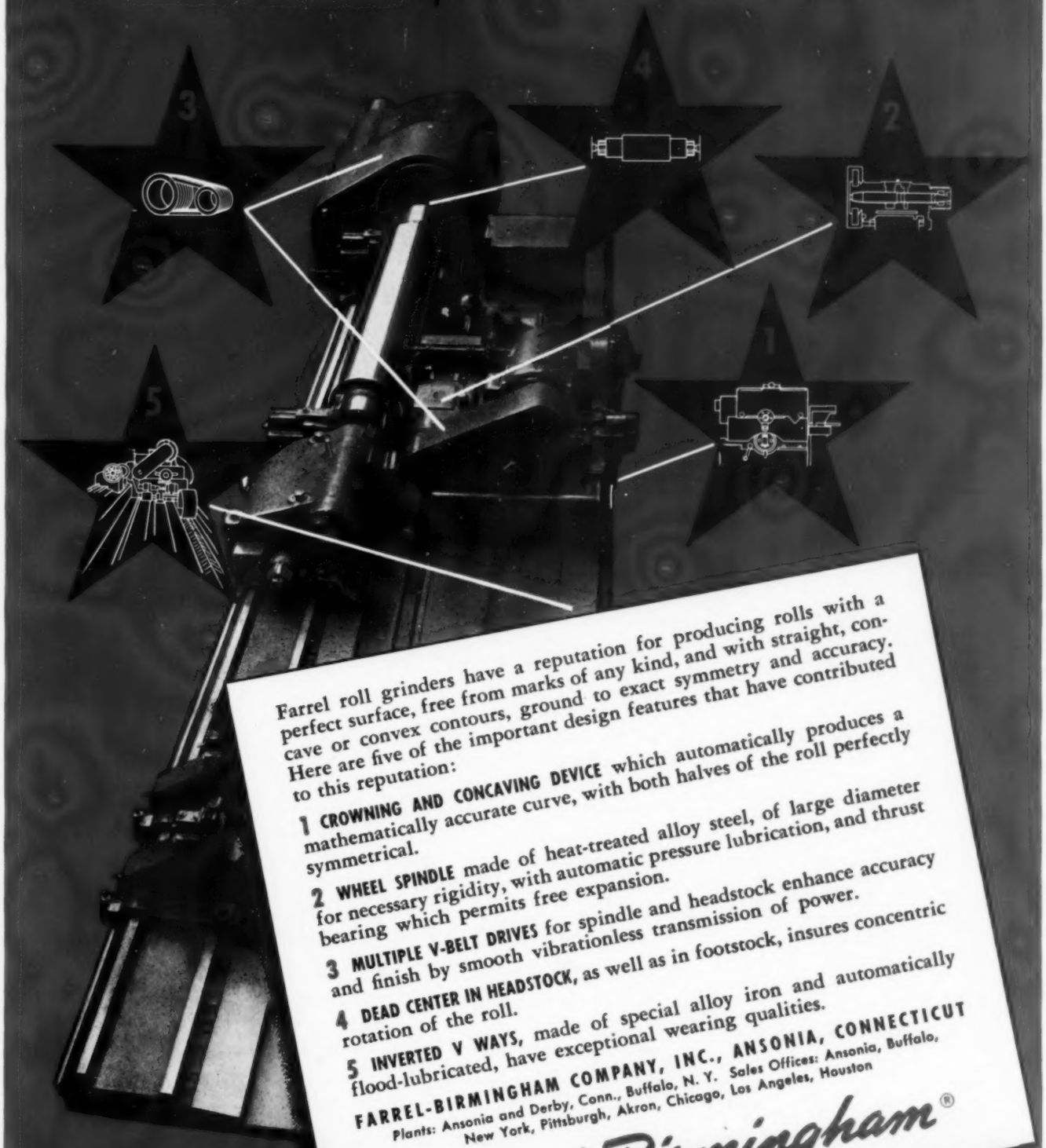
The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI, OHIO

AUTOMATIC PRECISION is a *five-star feature* of Farrel Roll Grinders



Farrel roll grinders have a reputation for producing rolls with a perfect surface, free from marks of any kind, and with straight, concave or convex contours, ground to exact symmetry and accuracy. Here are five of the important design features that have contributed to this reputation:

1 CROWNING AND CONCAVING DEVICE which automatically produces a mathematically accurate curve, with both halves of the roll perfectly symmetrical.

2 WHEEL SPINDLE made of heat-treated alloy steel, of large diameter for necessary rigidity, with automatic pressure lubrication, and thrust bearing which permits free expansion.

3 MULTIPLE V-BELT DRIVES for spindle and headstock enhance accuracy and finish by smooth vibrationless transmission of power.

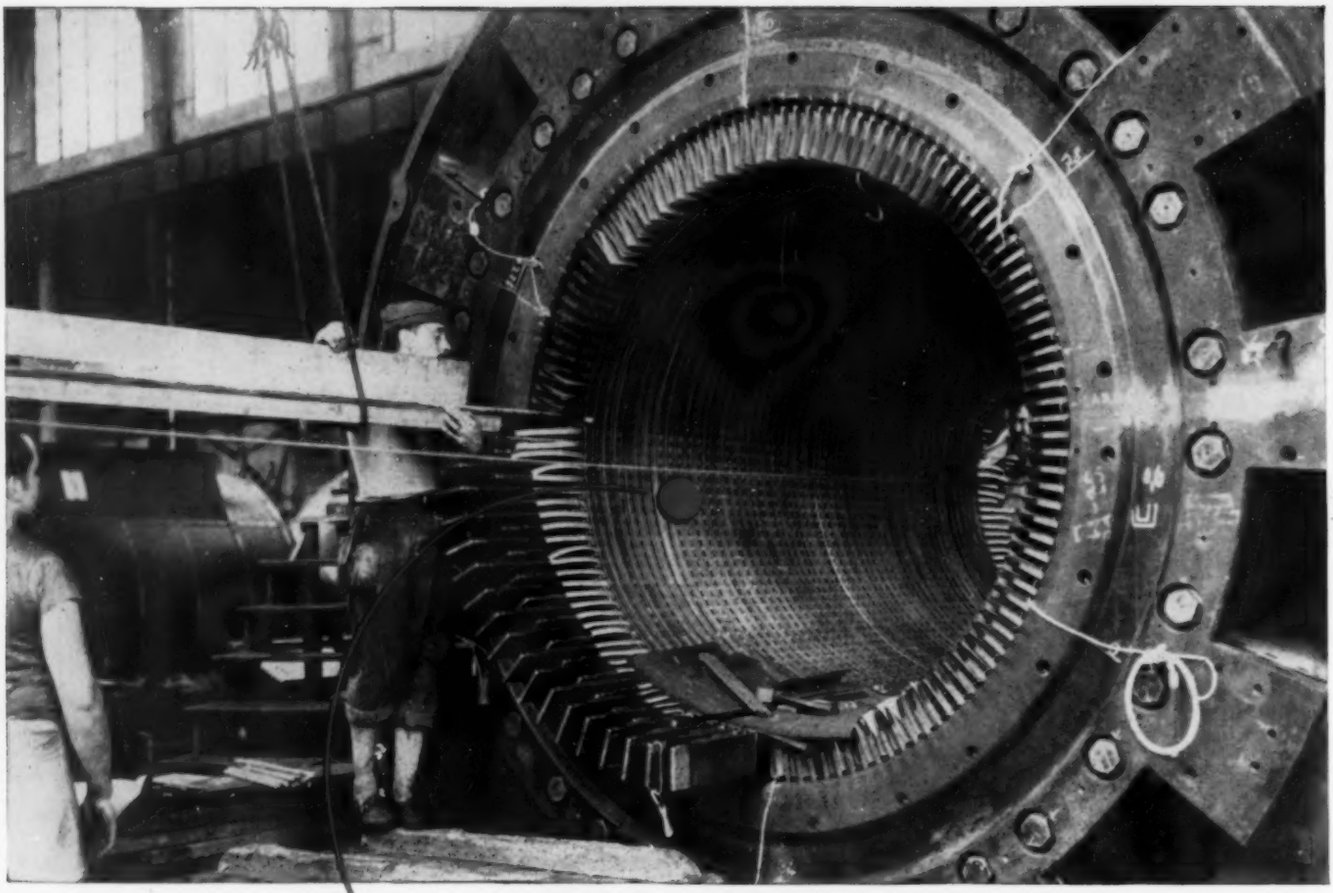
4 DEAD CENTER IN HEADSTOCK, as well as in footstock, insures concentric rotation of the roll.

5 INVERTED V WAYS, made of special alloy iron and automatically flood-lubricated, have exceptional wearing qualities.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Pittsburgh, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

Farrel roll grinders are available in two types — type HD shown here, and type TT with traveling work table. Bulletins giving complete specifications of either type will be sent promptly on request.



National gave this generator brand-new power

In the illustration at the top of the page the coil bars are being drawn into position. The lower illustration shows the coils being connected to the leads. This 3-phase, 50-cycle, 13,800-volt generator develops 45,000-kva at 1500-rpm.

Extra flexibility was needed in this rebuilding job. When the generator failed it was necessary to find someone who was equipped to handle the specialized repairs which were required. National was chosen. National engineers and technicians completely redesigned the stator windings; the National shops produced the bar design low-loss Roebel transposition type coils; and a National engineer was right there on the ground to supervise the actual rewinding of the generator. The result? A stator which gives more power at a lower operating temperature.

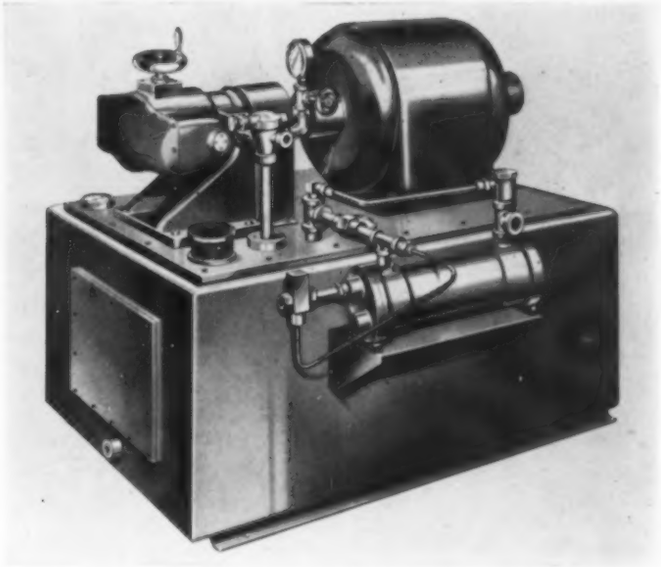
National can do the same for *your* motors or generators, whether they are special or not. Our experience and equipment are ready to work for you and to lower your power costs. Write or wire (or cable NATCOIL) *today.*

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

MORE MACHINE MANUFACTURERS INSTALL MARVEL SYNCLINAL FILTERS AS ORIGINAL EQUIPMENT



Large series hydraulic pumping unit manufactured by The Denison Engineering Co., Columbus, Ohio to recommendations of the Joint Industry Conference. These pumping units are equipped with Marvel Synclinal Filters.

They Know That ONLY ACTIVE FILTER AREA COUNTS!

It isn't the total amount of filtering mesh that may be squeezed into a filter unit but the amount of ACTIVE, WORKING filter mesh that counts. Surplus mesh not only fails to filter but obstructs the passage and slows the flow. A too crowded unit does not have adequate space for storage of accumulated foreign matter — tightly packed pleats of mesh can soon become clogged with filtered out material. Marvel synclinal Filters are balanced to provide maximum mesh area for all the liquid which can pass through the space and allow necessary room for filtered out material. That is why they excel in maintaining efficiency through longer periods between cleanings. Not only is the frequency of cleaning reduced but disassembly, cleaning and reassembly is so simple that ordinary workmen can do it quickly.

LINE TYPE
(Cutaway)

MARVEL BALANCED SYNCLINAL DESIGN

UNBALANCED BY INACTIVE FILTER AREA

SUMP TYPE
(Cutaway)

FACTS — NOT CLAIMS

"Campaign promise" claims mean little to engineers. They want the record, measurable facts. That is why over

260 MANUFACTURERS have picked Marvel Synclinal Filters AS THEIR O.E.M. CHOICE

Meets J. I. C. Standards

Sump and line models available in capacities from 5 to 100 g.p.m. Mesh sizes from 30 to 200. All models operate in any position. Line models may be serviced without disturbing pipe connections. For efficient filtration of non-corrosive liquids in hydraulic and low pressure systems, Marvel has your answer.

For complete engineering data write for catalog 105.

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

STOP RUST! with RUST-OLEUM

Protects Tanks, Pipes, Girders, Metal Sash, Fences, Roofs and Buildings, Rail and Marine Facilities

BEAUTIFY AS YOU PROTECT—ALL COLORS, ALUMINUM AND WHITE!

RUST-OLEUM may be applied directly over *rusted surfaces without removing all the rust!* Just remove rust scale and loose particles with wire brush and sharp scrapers . . . then apply by brush, dip, or spray. Costly sandblasting and chemical pre-cleaning are not usually required. Easy as that to cut your maintenance costs. Specify **RUST-OLEUM** to your painting contractor or architect for *every rustable* metal surface! Prompt delivery from Industrial Distributor stocks in principal cities.

RUST-OLEUM CORPORATION
2442 Oakton Street • Evanston, Illinois

FREE SURVEY: A **RUST-OLEUM** specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest **RUST-OLEUM** distributor, or write for literature on your company letterhead.

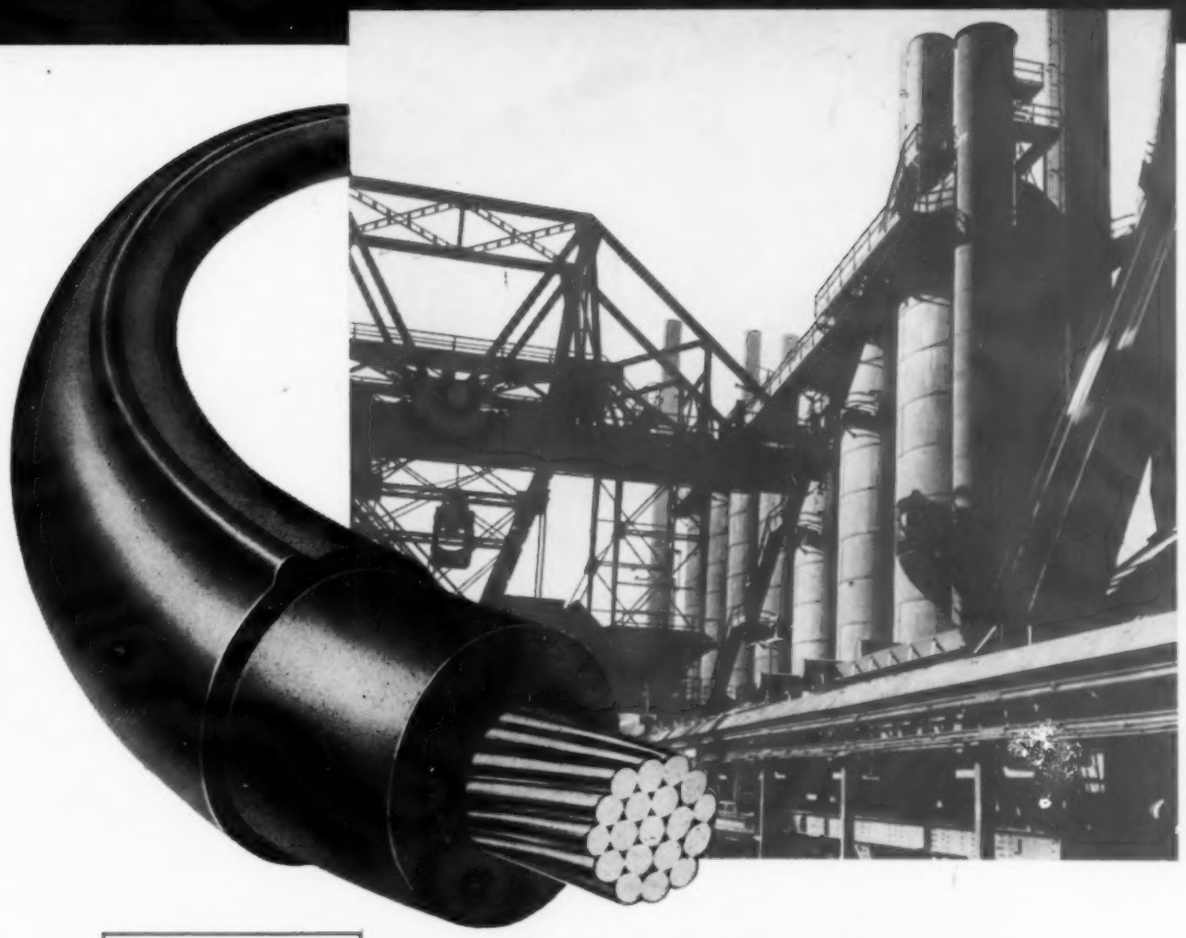
Stopping Rust with
RUST-OLEUM
769 D. P. Red Primer

CLIP THIS TO YOUR LETTERHEAD
MAIL TO: RUST-OLEUM CORPORATION
2442 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Full Details on Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

Look for this label – be sure it's genuine RUST-OLEUM

OKOLITE-OKOPRENE ELECTRICAL CABLE...



proved in the steel industry for long, trouble-free service

Only a cable specifically built to withstand the heat, moisture, oils, acids and abrasive conditions in steel mills can be installed with confidence in mill power circuits. Okolite-Okoprene cables are built that way, and have been proved for power and control wiring in mills throughout the U. S.

Their basic electrical insulation is Okolite, the moisture-resisting rubber compound being used so successfully on 35,000 volt submarine cables. Their outer protection is tough Okoprene that won't rot or deteriorate. This neoprene sheath withstands high temperatures and is highly resistant to chemicals, oils, flame, mechanical damage, and any degree of moisture.

Both sheath and insulation, applied by Okonite's famed strip process, are bonded together during vulcanization in a metal mold. Only Okonite uses this precision method of manufacture in regular production.

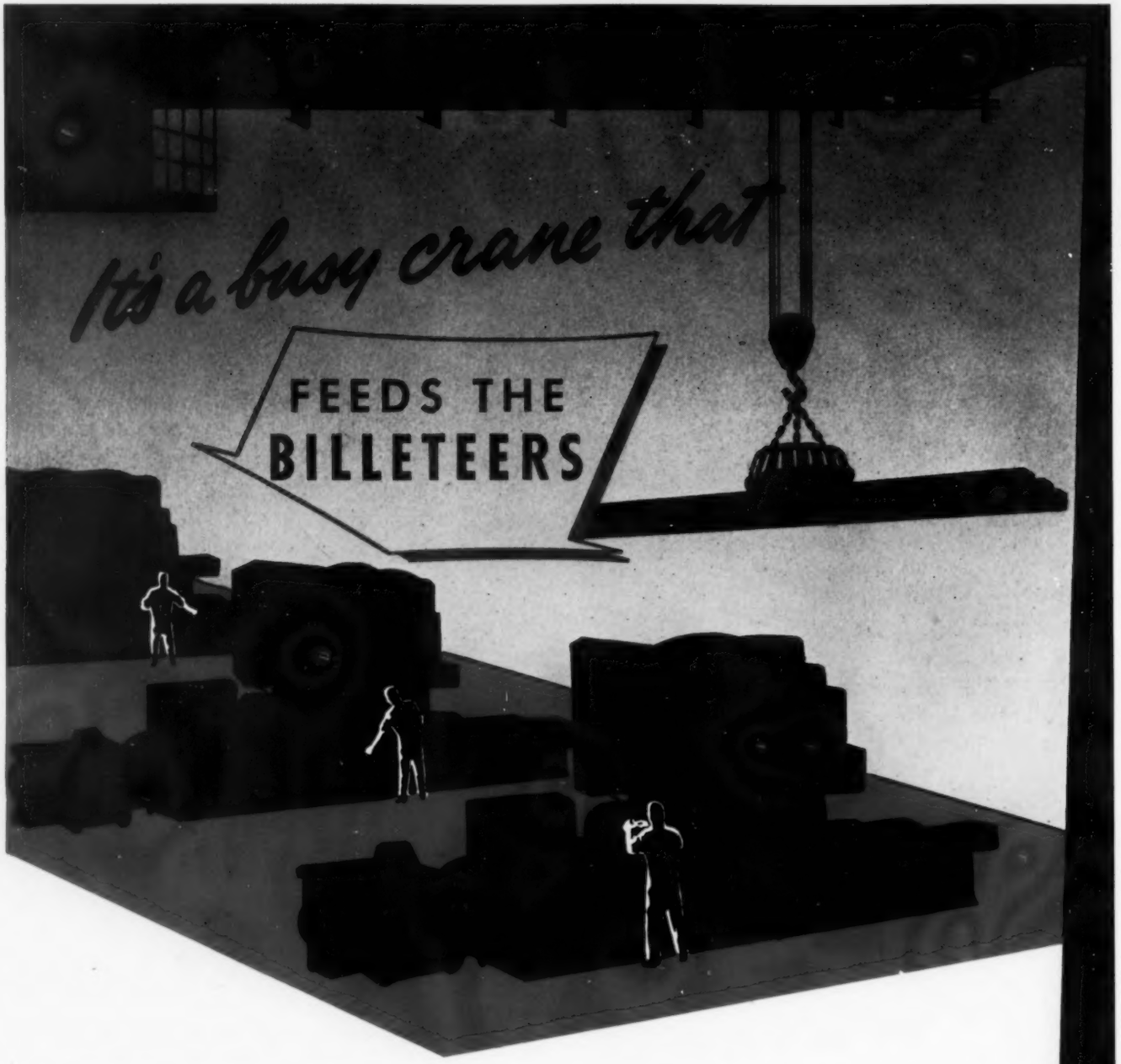
To provide extra insurance against circuit outages, Okolite-Okoprene cables are shipped out only after passing the most severe a-c and d-c tests used in the industry.

Your Okonite representative can show you how Okolite-Okoprene cables will add years of service to your power circuits. Call him in today; or write for Bulletin IS-1053. The Okonite Company, Passaic, N. J.

The best cable is your best policy

OKONITE OKONITE SINCE 1878 *insulated wires and cables*

9674



Busy is scarcely the word for steel plants and their cranes these days. They're being pushed to extra capacity! But regardless of demands, the Bonnet Billeteer produces to meet any and every emergency. For instance:

When **SPEED** is essential, actual tests on SAE 4150 steel show the Billeteer chips 49 times faster than hand chippers.

When **SAFETY** is considered, "Billeteering" records show as many as 490,000 manhours without a disabling accident.

When **MANPOWER** is vital, Billeteers reduce manpower turnover — increase individual productivity.

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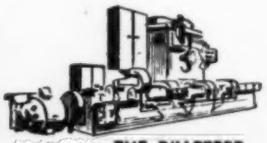

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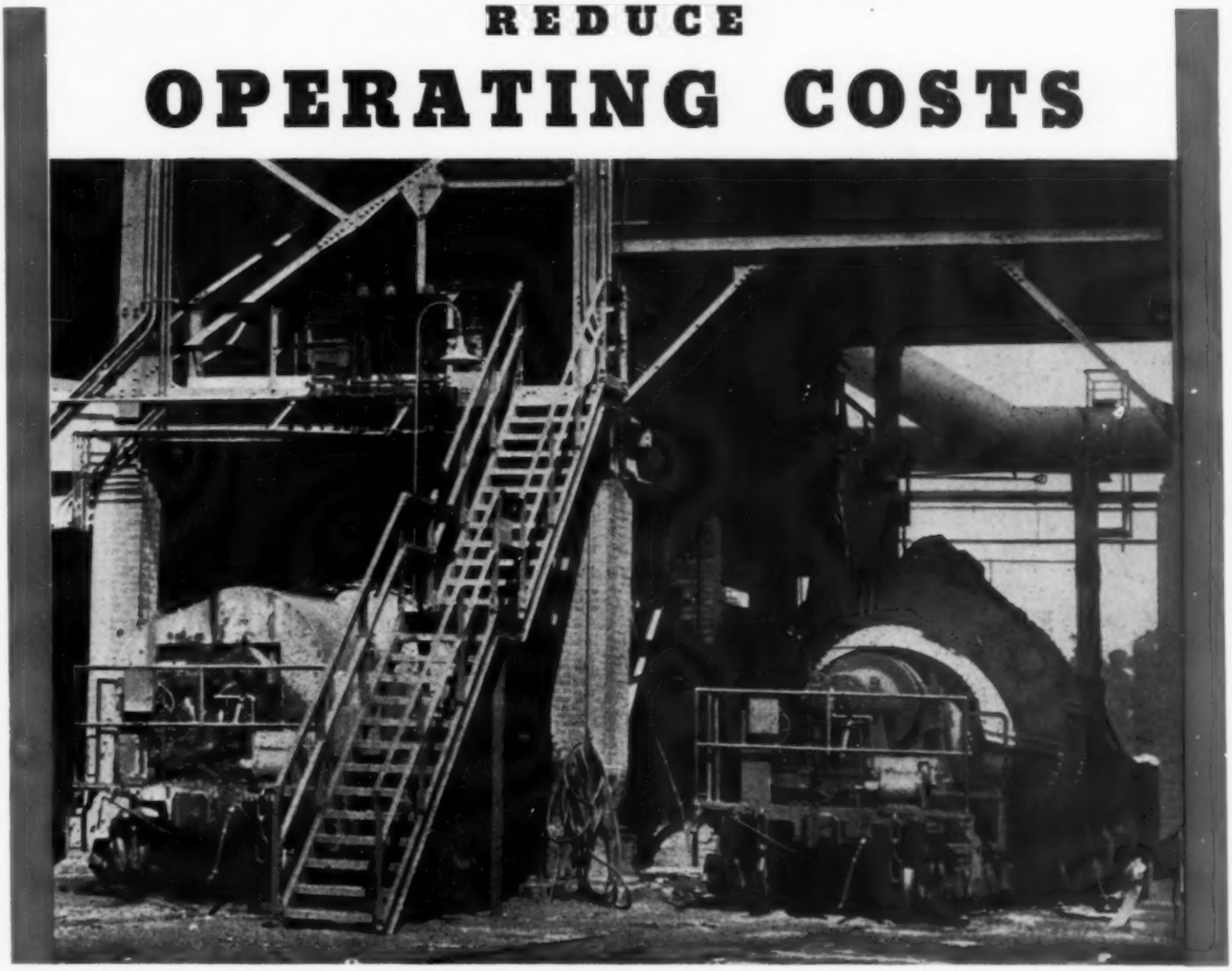

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Please accept our appreciation and our support of your recently published *Carbon Brush Standards*. After years of study and promotion of brush standardization, we are gratified that the AISE has established a line of dimensionally interchangeable, mill motor brushes. They make available to every steel mill in the country certain operating economies which to us appear both clear and substantial.

Anticipating wide-spread acceptance of your standards, we are hastening to advise mill operators that a complete line of "NATIONAL" mill motor brushes has been built to conform to AISE standard specifications in every particular—designed for optimum performance on AISE-specified motors at minimum cost. The grades employed are performance-proved by years of successful application. Shunt connections are of a vibration-resistant, tamped type.

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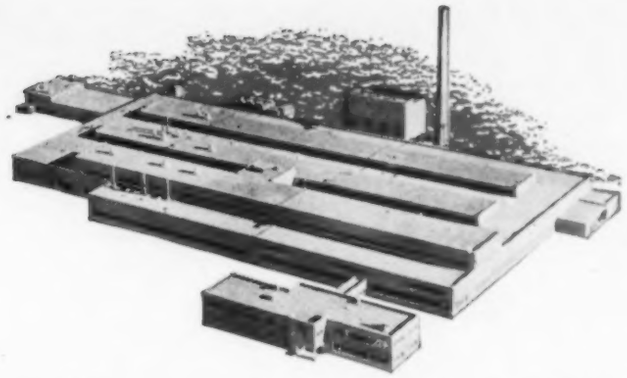

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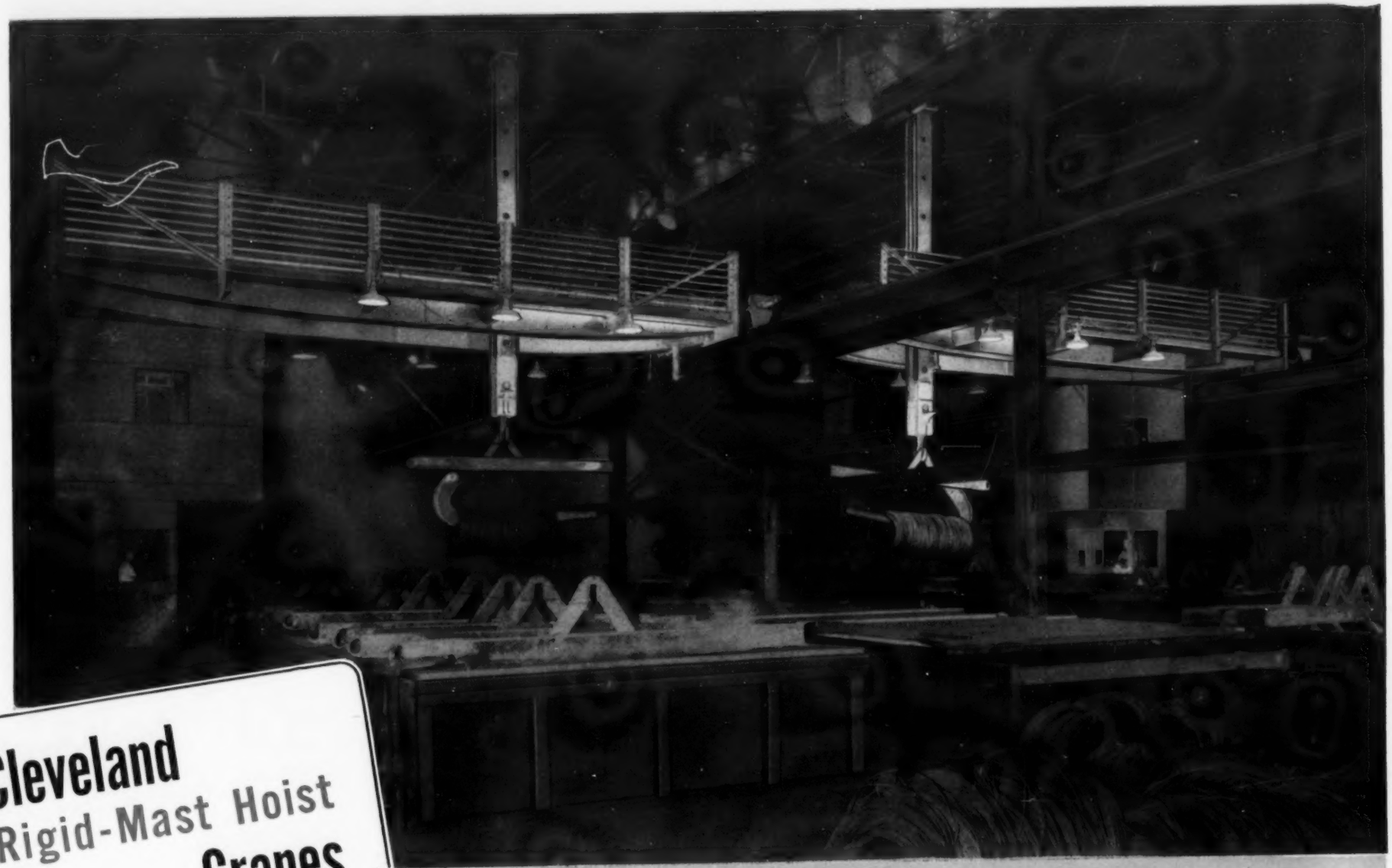

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Crops *and* Shorts

THE new home of United States Steel at 525 William Penn Place, Pittsburgh, Pa., is a slender column of stainless steel and limestone rising 520 ft without projection or set-back above street level. Nine floors of the building are occupied by Mellon interests and 30 floors by offices of the steel company.

Features of the building include a 26 ft turntable in the basement for trucks, and an automatic conveyor system capable of handling 10,000,000 pieces of mail per year from a central mail department to each floor. A modern telephone switchboard, connecting 240 local trunk lines and 137 private lines to approximately 2000 dial stations and 3800 extension phones, is manned by 26 operators and will handle about 4,500,000 calls per year. Automatic telegraph contact is maintained over the company leased wire system of 103 circuits with 152 stations in 85 cities.

Modern in every respect, the building provides fine restaurant facilities, library, barber shop, medical dispensary, lounges, etc. Executive offices are tastefully decorated according to the individual preferences of the occupants.

▲

PHILLIP MURRAY has been quoted in the daily press as saying, "The steel industry can go to hell with my compliments." This is not a pretty statement from one who is supposed to be looking out for the welfare of those who are dependent on the steel industry for their livelihood, but it is typical of the distrust, ridicule and tough, profane talk so evident — and so evidently prearranged — at the USWA convention in Atlantic City.

▲

THOMAS D. JOLLY, vice president of the Aluminum Company of America, has just been succeeded as president of the American Standards Association by R. E. Gay, president of Bristol Brass Corporation. We don't know whether ASA is in a rut, but we know men by the names of Joy, Merry, Bliss, Bright, Witty, Smiley and Blythe.

▲

ADDRESSING a group of business magazine editors recently, Roger L. Putnam, new director of economic stabilization, said that, since the steelworkers were willing to postpone their strike pending the decision of stabilization board fact-finders, the steel companies would not be good Americans if they did not accept the decision by the time of the USWA deadline, even though no decision had been reached regarding steel prices. Mr. Putnam apparently overlooked the fact that the union postponement was predicated on a retroactive wage increase — or maybe he knows how to make a price increase retroactive, too.

Mr. Putnam has also expressed the opinion that the steel industry can absorb a "certain amount" of wage increases without raising steel prices. We wonder if Mr. Putnam also thinks that the federal administration can absorb the resulting reduction in its tax take without attempting to recapture it elsewhere.

▲

IN this year of election we'll hear all sorts of accusations traded about who is to blame for the mess this country is in. Basically, the blame might go back to the Indians. They should have been stricter about admitting so many trouble-breeding aliens.

▲

DURING the latter part of 1951, the German Federal Republic (West Germany) produced pig iron at a rate of 950,000 tons per month and steel ingots at a rate of 1,150,000 tons per month. Of this production, 20-30 per cent is dependent on fuel supplies from the United States.

▲

IN 1951 Great Britain was the only country in the world whose steel production dropped under its 1950 output — scarcely a recommendation for nationalization.

▲

PERHAPS it's a sign of the times that a horticultural volume, "The Grafter's Handbook," was listed recently in a book catalog under the general heading "Government."

▲

THE Mahoning Valley Technical Societies, who are building up a reference library in Youngstown, Ohio, report that, in response to a recent item on this page, they have received some bound volumes of AISE proceedings, but they are still in need of the volumes for 1932-34, 1938, 1940, 1941, 1942, 1943, 1944 and 1945. Perhaps some reader who is no longer using these volumes will be willing to donate them to this library, where they will be useful to many men in the industry.

▲

ACCORDING to the Safety Broadcast, an evangelist announced there's a total of 726 sins — and now he's getting requests for the list from people who think they must be missing something.

▲

THIS year marks the 200th anniversary of Benjamin Franklin's famous kite flying, which drew electrical charges from the atmosphere and proved the electrical nature of lightening.

▲

IRON ore explorations have been carried out in Minnesota by seismic methods. A reflection seismograph is used to make subsurface maps and to determine the depth of overlay quickly and economically.

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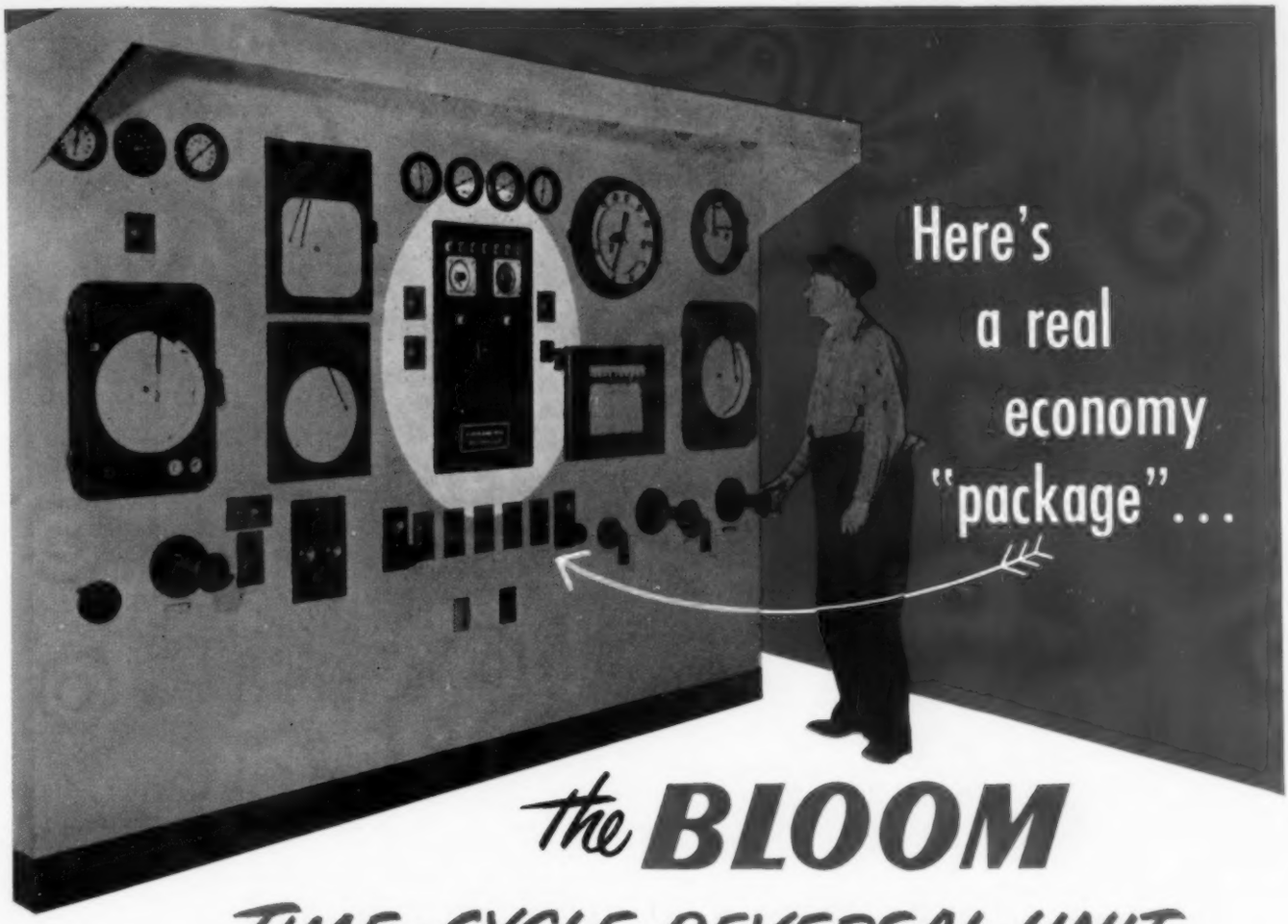

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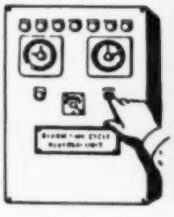
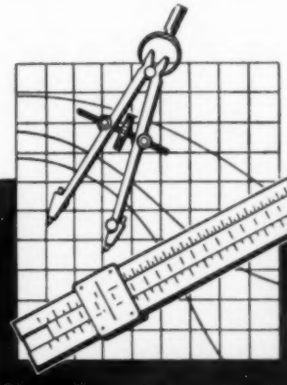


In case reversal is desired ahead of schedule, the operator merely pushes the reversal button. After reversal, furnace returns to original timing.



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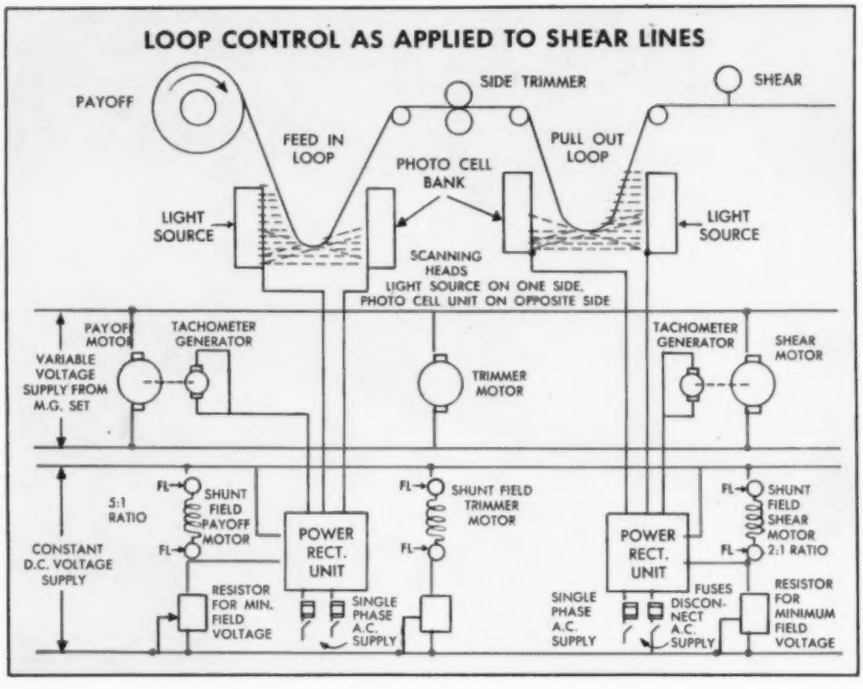

When light projected on the photocells is modulated by the loop, it produces a signal voltage proportional to the loop position. This photocell signal is amplified, and in turn controls the output voltage of the power rectifiers.

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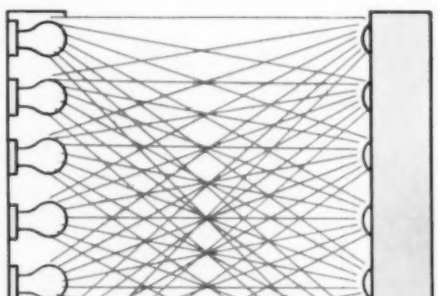

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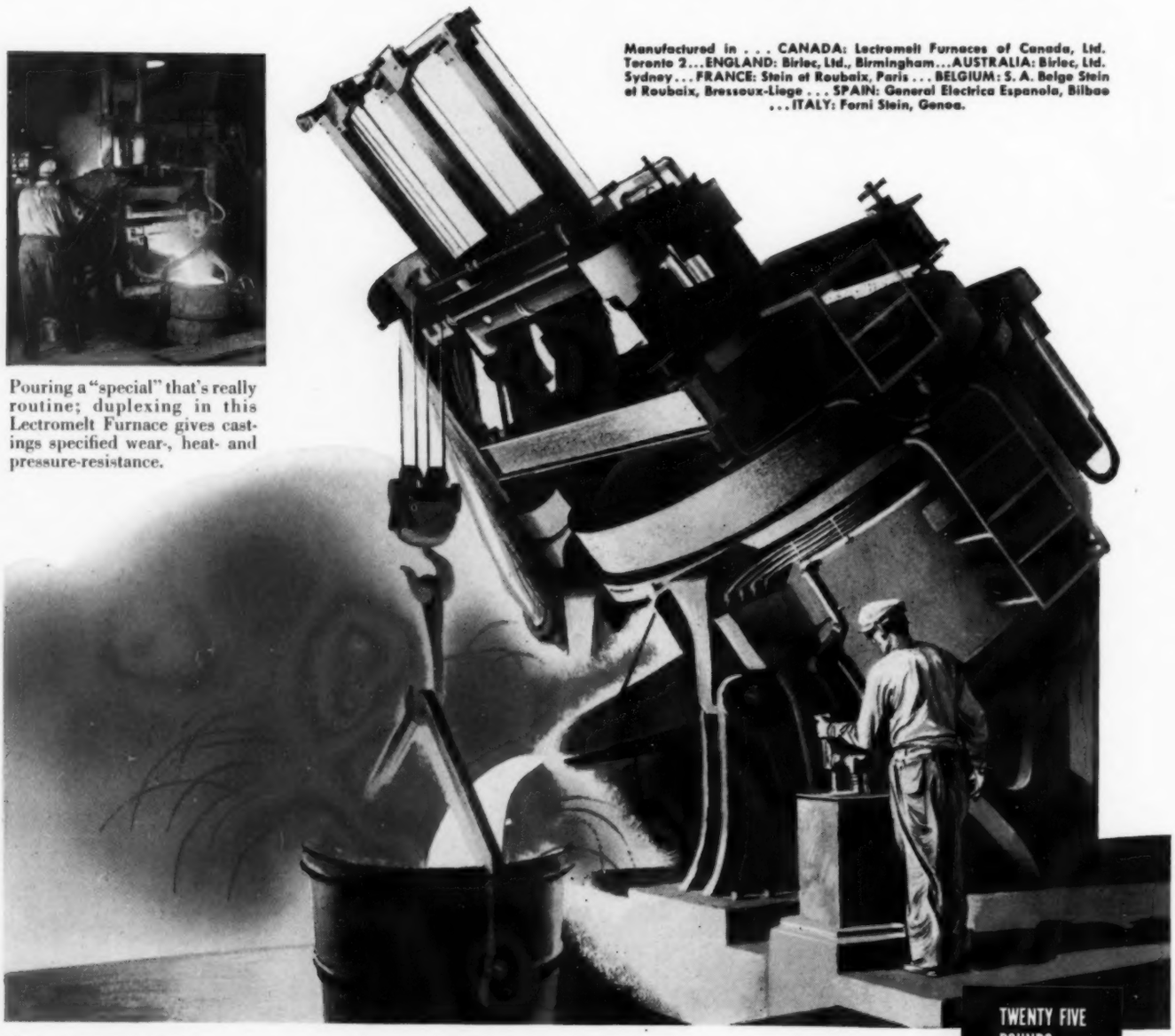

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*REG. T. M. U. S. PAT. OFF.

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

Descaling of Carbon Steels
IN MODERN MERCHANT MILL PRACTICE

By C. S. LAMBERT
Superintendent Merchant Mills
Youngstown Sheet and Tube Co.
Youngstown, Ohio.

. . . . descaling is a necessity in the rolling of quality merchant mill products . . . .

▲ FOR many years the merchant mills of this country have been confronted, and still are to a lesser degree, with the problem of surface quality. The problem is to produce bars free of rolled in scale, slivers, tearing, shearing and other superficial defects. Of greatest concern are blemishes, traces of which remain in evidence after cold drawing, polishing, forming or upsetting.

Greater emphasis is placed today on the surface quality of hot rolled bars than ever before due to an increasing number of applications complicated by more exacting metallurgical requirements, the increasing demand for higher carbon and alloy steels, the development of cold and hot metalworking machinery using bar stock, and in some cases the substitution of bar stock for forgings. The merchant mill operator of today must be acutely aware of an increased demand for quality and be cognizant of the methods by which many defects can be removed or in a large measure be prevented.

As is well known, efficient scale removal is of primary importance, as scale is the origin of many quality problems in the rolling of rounds, flats and hexagons.

TYPES OF SCALE

In making a study of scale removal, it must be recognized that there are two types of scale which must be considered—primary scale and secondary scale. Each type has inherent and distinct characteristics requiring individual consideration. Scale is the result of oxidation which takes place during the heating of steel in an oxidizing atmosphere or during exposure to air while at elevated temperatures. The oxide film thickness varies according to the composition of the steel, and the time and temperature of exposure to the oxidizing atmosphere. Primary scale, or that which is initially formed on the billet in the reheating furnace, will generally have the most detrimental effect on the product and must be removed prior to entry into the roughing mill. Secondary scale is formed during the rolling process where the bar is exposed to the atmosphere for a short period of time between stands. Like primary scale, it must be removed in order to produce a bar of good quality.

Figure 1 — The high pressure spray nozzle is positioned just back of the scale breaker rolls.

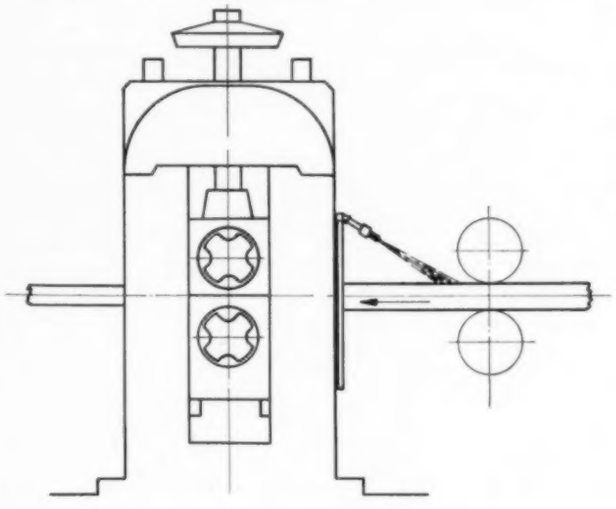
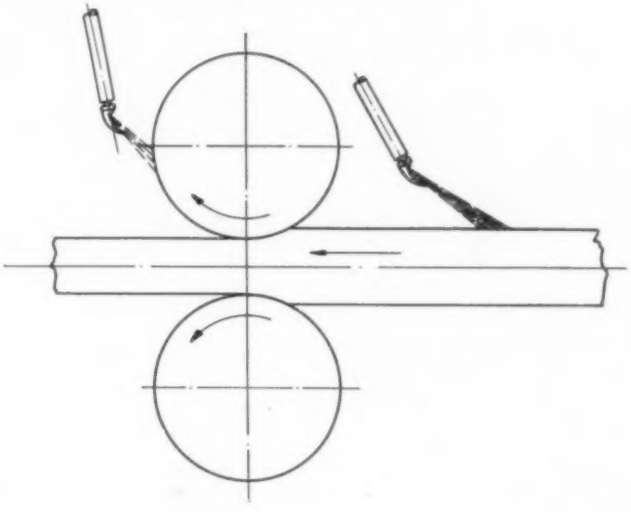


Figure 2 — Spray nozzle is used on entry side for descaling and on the delivery side for roll cooling.



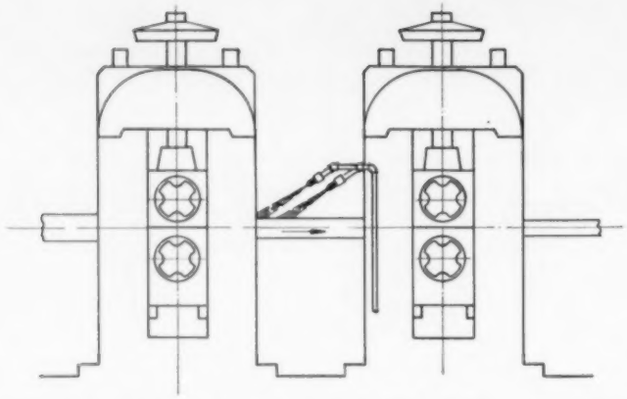


Figure 3 — This installation is used for descaling large billets or slabs in the 12-in. cross country mill.

DISADVANTAGES OF SCALE

If primary scale is allowed to adhere to the bar and is rolled in by the roughing train, it may fall out in spots in succeeding passes, leaving a depression in the finished bar. Furthermore, rolled-in primary scale which does not fall out during the rolling process will often be revealed as scale pits after pickling and prior to cold drawing of the bar. The peculiar characteristic of secondary or thin scale is evidenced by a scale mottle and pits on the finished bar which normally cannot be removed by pickling. Such bars are therefore not applicable to the end product when a bright finish is required. Both types of scale, if not removed, will follow the bar through the mill and possibly adhere to the rolls or guides causing shearing and tearing of the bar.

METHODS OF REMOVING SCALE

For many years operators have experimented with numerous mechanical devices for removing scale, such as scrapers, hold-downs and wire brushes. These were followed by the application of steam, compressed air and high pressure water. Of all these methods, high pressure water has proved to be the most economical and efficient means of descaling carbon steel in the rolling of merchant bars. However, a hydraulic descaling installation will not guarantee good surface quality unless it is correctly arranged and effectively used. Indiscriminate use of high-pressure water may result in more adverse effects than benefits. Various mills use high-pressure water for scale removal with pressures ranging from 350 to 1300 psi. Pressure selections are influenced by type of mill, section sizes and, in some cases, available equipment. Installations throughout the industry are varied and in some cases unique. However, all have dealt with the scale problem with various degrees of success.

The author has experimented with diversified arrangements of spray systems in merchant mills over a long period of time. A number of these successful arrangements will be outlined in this paper.

REMOVAL OF SCALE BY HIGH-PRESSURE WATER

The following applications have been and are still being used on a 9-in. looping mill and a 12-in. cross-country mill. The size of the billets used on these mills range from 4 × 2-in. to 7 × 2¾-in. slabs and 1⅞ to 4-in. square billets on the 12-in. mill and 1⅞ to 2½-in. square billets on the 9-in. mill. In the author's opinion, a pressure of 650 to 750 psi has proven to be ample for good, efficient descaling for these mills. Pressures below this have not been effective, whereas those in excess are hard to control due to excessive wear of nozzles, fittings and pumps.

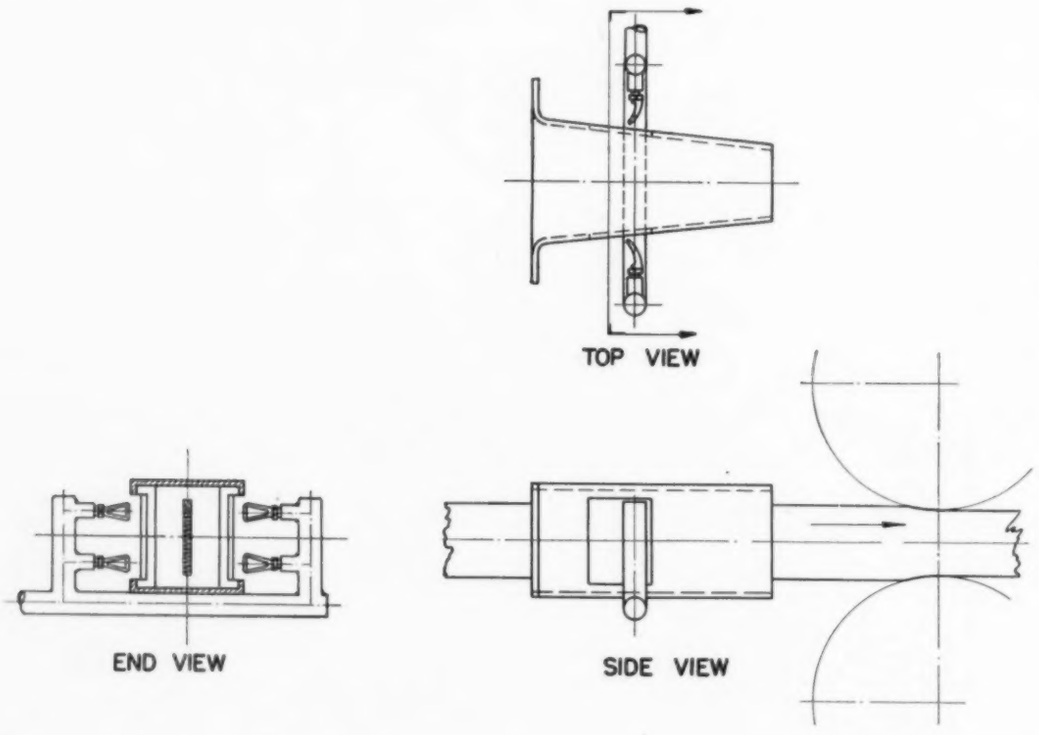


Figure 4 — Spray nozzle installation for descaling of flats in edging passes.

Figure 5 — Micrograph illustrates an example of a properly cleaned flat.

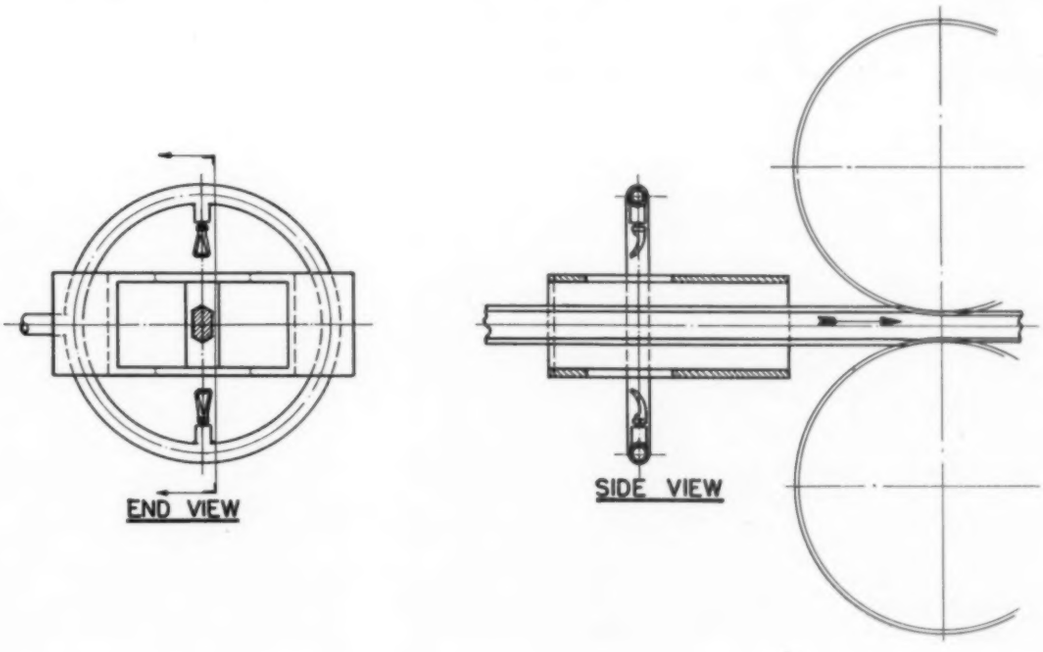
An important factor which cannot be overlooked in high-pressure descaling is the danger of excessive cooling of the bar by an over-abundant use of water. The quantity of water should be determined by a careful analysis of the size of the section at the point of descaling. Flow control is established by correct selection of the spray orifice size. It is not to be inferred that a large stock of nozzles must be available with a finely graduated range of orifice sizes, as usually two or three sizes are ample in providing a selection of discharge rates.

Removal of primary scale on the 9-in. mill is accomplished by passing the billet through a set of pinch rolls or so-called scale breaker rolls immediately upon discharging from the furnace. A small amount of pressure is exerted by these rolls to assist in entering the billet in No. 1 roughing stand and also serves to fracture the scale formed on the billet during heating. As shown in Figure 1, a high-pressure nozzle with an orifice of 3/16-in. is shown immediately after the pinch rolls. This nozzle is positioned 4 in. above and at an angle of from 30 to 35 degrees to the bar, allowing the high-pressure water to produce a chisel-like action in removing the scale. This application has proven highly successful and has eliminated delays and poor product due to shearing and tearing formerly caused by scale clogging in or adhering to the face of the guides.

After leaving the No. 2 roughing stand, the bar travels across a table 30 ft in length at a rate of 187 fpm prior to entering No. 3 stand. This short exposure to the atmosphere (9.6 sec) is sufficient time to permit formation of secondary scale which must also be removed. At No. 3 stand and as shown in Figure 2, a spray nozzle is installed similar to that used to remove the primary scale. However, in this instance, the spray nozzle has a smaller orifice to compensate for the reduction in cross sectional area of the billet. Thus excessive cooling is avoided while scale is effectively removed. The same illustration shows a high-pressure spray located directly above the top delivery guide, so that a jet will impinge directly on the roll pass. The purpose of this spray is to provide effective cooling of the pass as well as to wash away adhering scale. This feature has proven to be highly beneficial, as roll life has increased 40 to 60 per cent in connection with many of the sections rolled. One may question the possibility of the danger of over-cooling the section. As previously mentioned, this can be avoided by controlling the flow of water by choice of correct orifice size. No high-pressure water is used in the finishing stands due to the small cross-sectional area of products and the need for a high finishing temperature. It has been experienced that excessive cooling of sharp corners of any section appreciably reduces roll life. This is particularly true of ovals and flats entering edging passes.

The means by which primary scale is eliminated on the 12-in. cross-country mill is essentially the same as shown in Figure 3, with the exception that an additional spray is installed when rolling slabs and large billets so as to provide complete coverage. Due to the design of this mill, the bar is not in more than one stand at any one time. Hence, due to the delay between stands, secondary scale is a greater problem.

Figure 6 — Spray nozzle installation for descaling hexagons and rounds.



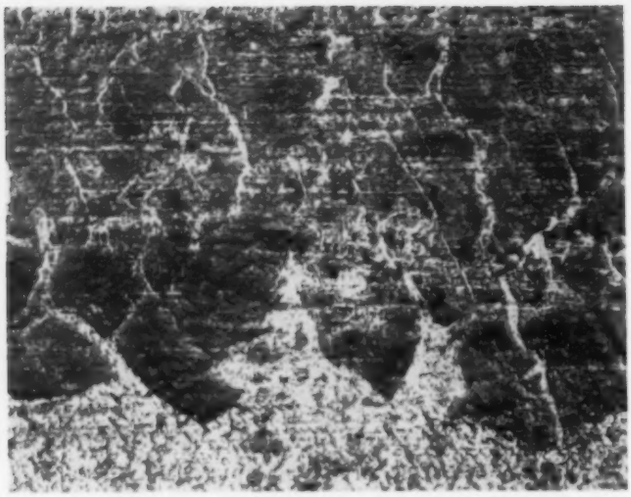


Figure 7 — Micrograph shows that hot rolled hexagon has not been properly cleaned as illustrated by the heavy scale pattern.

Collar marks have always been an annoyance in rolling square edge flats. They can be prevented if the flats are properly descaled prior to entry into edging passes. After some experimentation it was found that the installation of a box on the entering side of the pass with four high-pressure spray nozzles directed toward the sides of the flats functioned very well in removing scale and resulted in eliminating collar marks. Figure 4 illustrates the spray box showing the sprays installed on either side of the flat. An example of a properly cleaned flat is illustrated by Figure 5.

In rolling hexagons and rounds on the 12-in. mill, secondary scale is removed by an installation of a spray nozzle on the top and bottom on the section as shown in Figure 6. This spray position has proven to be very effective. Pass life has been increased, reconditioning cost reduced and a great improvement in product noted. A similar installation has been used to advantage in rolling structural sections. Spray nozzles were used on the leader and finisher passes, thereby eliminating heavy scale and pits.

Figure 8 — This is the same bar as shown in Figure 7 after being cold drawn. The scale pattern and pits are very noticeable.

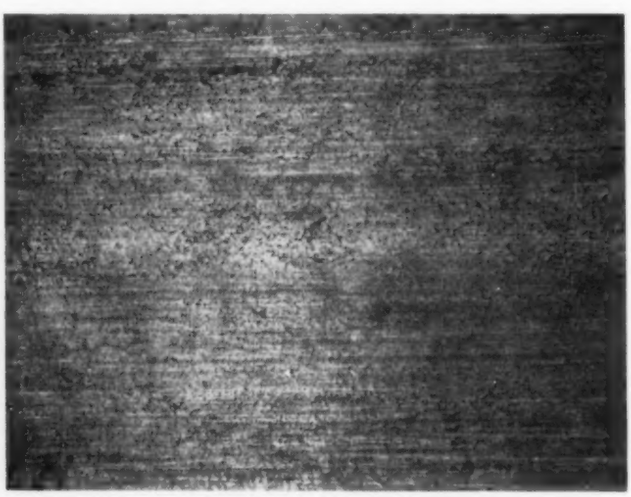
Figure 9 — Hot rolled bar has been properly descaled in the hot rolling and is ready for the cold drawing.

The following (magnified) illustrations show the effects of scale on a finished bar as contrasted to a clean bar. Figure 7 shows a hot rolled hexagon which has been pickled and is ready to be drawn. This hexagon has not been properly cleaned in the hot rolling as is shown by the heavy scale pattern. The next illustration, Figure 8, shows the same bar after being cold drawn whereon the scale pattern and pits are very noticeable. This section would normally be rejected. Figure 9 shows a hot rolled bar that has been properly descaled in the hot rolling and ready for cold drawing. No scale pattern is evident. Figure 10 shows the same bar, after being cold drawn, free from scale marks, pits and mottle.

TYPES OF SPRAY NOZZLES

The question of type or make of spray nozzles is very controversial and a lively subject for discussion among operators. The types illustrated here have been most successful under the conditions encountered. Conditions at other mills may be more favorable for the use

Figure 10 — This is the same bar as shown in Figure 9. Note that it is free from scale marks, pits and mottle.



of other types. The life of any spray nozzle is dependent on the condition of the water used. Where dirty water containing slag, scale or other abrasive matter is used, the life of the spray nozzles has been considerably reduced. For economical operation clean water is highly recommended. Even though the intake water may be poor, the installation of a screen and a settling tank ahead of the high-pressure pump can be effective in providing clean water for descaling. Figure 11 shows two types of so-called deflector spray nozzles with their respective spray patterns. This type of spray is most effective in removing light or secondary scale. It has been proven by experience that a flat spray pattern has a greater chisel-like action and is more effective than the oval pattern on merchant mill products. At this

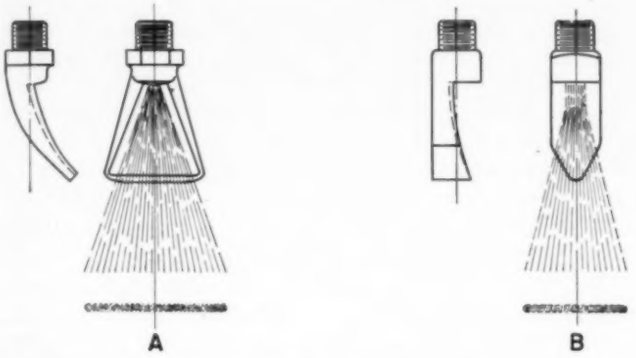
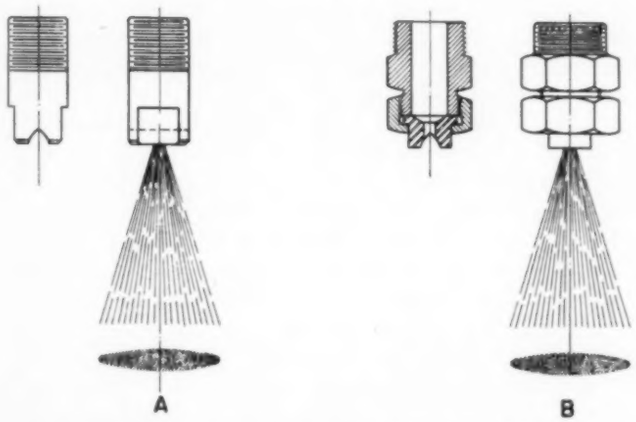


Figure 11 — Deflector type spray nozzles show typical spray patterns.

Figure 12 — On left is shown a center jet type spray nozzle and on right is shown the same type except that the nozzle orifice is an insert.



point it should again be emphasized that the angle at which the spray strikes the billet or bar has a great deal to do with the effectiveness of the spray nozzle. As previously stated, 30 to 35 degrees is considered to be the best position. However, a different nozzle type or pressure could make for other optimum angles. These nozzles can be purchased commercially in brass, high carbon steel, and stainless steel. Stainless is recommended as the best for this application, as exhaustive tests have shown that it has the best wearing qualities.

The sizes of orifices used in our installation range from $\frac{1}{8}$ to $\frac{3}{16}$ in., discharging 7 to 15.5 gpm at 600 psi pressure respectively. It is obvious that the pump must have sufficient capacity to provide for the number of nozzles required for proper descaling without a loss in line pressure. The mills described have a pump which provides for 375 gpm or enough to supply eighteen spray nozzles with a $\frac{3}{16}$-in. orifice.

Figure 12A illustrates a center jet type spray nozzle which delivers an oval spray pattern. This type of nozzle is most effective for removal of primary scale due to the heavier spray pattern. However, it is recommended only for large sections, as this spray emits approximately 40 per cent more water than the deflector type spray nozzle. This type of spray is also commercially sold in high carbon steel and stainless steel and has demonstrated excellent wearing qualities. Figure 12B is very similar to that shown in 12A with the exception that the nozzle orifice is an insert made of sintered-carbide. This insert has shown remarkable wearing qualities and is well recommended for general use. In this regard it may be that the practical solution for increased wear is to redesign the deflector type nozzle to incorporate a sintered-carbide insert which can be readily replaced when it is no longer of any value.

SUMMARY

There is no doubt that hydraulic descaling has become a must for rolling quality merchant mill products. Not only does it insure a bar free of rolled-in scale, but it has also substantially increased roll and pass life. In addition, delays due to changing or grinding guides have been reduced, with a corresponding reduction in guide shearing and tearing.

DISCUSSION

PRESENTED BY

J. A. TISCHBEIN, Assistant Superintendent Continuous Sheet and Strip Department, Pittsburgh District, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

C. S. LAMBERT, Superintendent Merchant Mills, Youngstown Sheet & Tube Co., Youngstown, Ohio.

F. A. HORN, Superintendent Bar Mills, Ford Motor Co., Rouge Plant, Dearborn, Mich.

LOUIS MOSES, Superintendent, Rail, Mill and Roll Dept., Bethlehem Steel Co., Sparrows Point, Md.

H. E. MULLER, Assistant Superintendent, Roll Department, Inland Steel Co., Indiana Harbor, Ind.

CLAYTON L. SQUIER, Assistant to Electrical Superintendent, Electrical Department, Bethlehem Steel Co., Lackawanna, N. Y.

J. A. Tischbein: We have found our hydraulic spray system to be very important when rolling bars. If at any time it is necessary for the hydraulic spray system to be shut off, the results are very noticeable, not only on the surface of the hot rolled bars, but also on the finished product in our cold drawn plant.

Mr. Lambert spoke about increased roll life. This is very true, particularly in the roughing mill where the scale is fairly heavy after being discharged from the heating furnaces. We have installed near our number

one stand at our 14-in. mill in Pittsburgh, a spray that cleans off all the heavy scale that has formed when leaving the furnace. This has helped us tremendously in our roll life at our No. 1 stand and the same is true throughout the rest of the mill in that a smoother surface on the mill rolls is maintained.

In the present system of our 14-in. mill, we operate our pump at a maximum capacity of about 900 to 1000 psi pressure. However, we have a certain line loss from our pump house to some of our stands throughout the mill. I was wondering how we could counteract this line loss of between 100 to 150 psi.

C. S. Lambert: In our high-pressure water installation, our feed line or manifold is approximately 6 in. diam, and that gives us a very nice cushion of water to work with. We have never experienced over 10 psi loss in pressure.

J. A. Tischbein: We have found that in rolling steel the temperature and speed of the mill is extremely important, particularly when rolling high sulphur steels. When rolling high sulphur bessemer, we have found that if we can finish with a very high temperature, we obtain a very flaky scale which falls off as the bar cools. We obtain a much superior bar, from a quality and surface standpoint. I would like Mr. Lambert to comment on heating and speed throughout the mill, particularly when using a hydraulic spray system.

C. S. Lambert: We attempt to finish each section as hot as possible in order to obtain a heavy flaky scale which will fall off as the section cools, thus reducing pickling time and providing a good surface in the cold drawn bar.

J. A. Tischbein: What precautions are you taking in eliminating clogging of your sprays, and what type of strainers are you now using?

C. S. Lambert: We are using a screen on our intake water,which is a rotary self cleaning type that has been very satisfactory. We have not experienced any difficulty in clogging as each spray is fed by a 1-in. line with a reducer immediately ahead of the spray. Our line pressure is sufficient with this set-up to eliminate clogging.

F. A. Horn: Are the so-called pinch rolls standard equipment?

C. S. Lambert: Yes, they are water cooled cast iron rolls.

F. A. Horn: You have water spray above the delivery guide on the top roll. Does this hold true for the bottom roll as well?

C. S. Lambert: No, we only use high pressure water on the top roll as our experience indicates the top roll picks up scale and wears faster due to the quality of water used in the pass.

F. A. Horn: Do you have this equipment installed on all your roughing stands?

C. S. Lambert: Yes, we have high-pressure water the entire length of the roughing mill for roll cooling.

F. A. Horn: Do you use a descaling installation prior to the finishing stand on rounds 1-in. and above?

C. S. Lambert: That is true. This is used on the 12-in. mill only. It has not proven feasible on the 9-in. mill due to the small sections rolled.

F. A. Horn: Some mills use the diamond and square method in the roughing mill, whereas others use box and edging passes. Which in your opinion is most beneficial from a descaling standpoint, as well as from quality of steel that has a tendency to be seamy, and cases where nickel content produces a tight scale?

C. S. Lambert: That is a big problem. However, I would say that the diamond and square method is the best in the roughing mills, especially where you have to recondition your steel.

Louis Moses: Our combustion engineers regulate the correct proportion of air to obtain maximum fuel values and economy; this is also effected by interior furnace pressure to prevent infiltration of free air. Reducing or oxidizing flames are produced as wanted and a compromise is usually used. Balancing between the mill's desires for a product's surface, as believed to be influenced by heating practice, and the objective of obtaining full efficiency from the fuel, it becomes necessary at times that all factors, including optimum production rates, be adjusted. Operators can congratulate the combustion men on the steel delivered from today's furnaces in contrast with the scaling conditions prevailing not too many years back. They must keep working on the problem, considering the violent affinity of iron for oxygen, but we shall probably always have the problem of primary scale removal to a degree, and methods to do so are indeed important.

The mill man is dismayed when a long delay occurs, for he well knows that an excessive coating of scale is forming on the steel laying on the furnace hearth. This is another way of saying that the mill enjoying a consistently steady production rate, hour by hour, has the least trouble with primary scale.

Every operator has noted variations in the kinds of scale as related to its removal. A lone heat will become sandwiched among many similar ones on which the scale will persist through the finishing pass. So far as chemical analysis or physical testing discloses, there is no difference from preceding or following heats. Called to the attention of metallurgical and steelmaking personnel, they give little in explanation. It has happened that when an operator has complained in such a case the burden of proof is up to him, and a breakdown of his own practices is under suspicion of cause. Fortunately, such heats are few and far between.

When possible to do so, the most efficient method of promptly ridding the billet, bloom or slab of primary scale is to apply an edging pass, and then turn the bar for a similar breaking away of the scale from the sides. There are many products and mill layouts whose rolling schemes do not permit such edging and it cannot be done without vertical rolls. Adhering furnace scale surely breaks away with the more or less pitted surface, resulting from the scale breaking out, becoming clean and easily ironed out in succeeding passes.

Speculation is often made on just how far roll pressures will actually penetrate. One phase of this, at least as far as surface disturbance shows, is evidenced at a 68-in. hot strip mill, where about 1-in. work on a vertical edging stand will break up the scale almost to the center of the flat surface of a $6\frac{1}{2} \times 60$-in. slab, and completely across the width of narrower ones. Here the relation of a 40-in. roll diam to a 60-in. width has its influence. A 16-in. roll with a groove 8-in. at bottom diam may or may not be as effective on an upedged 8-in. wide piece, but it would be effective enough. Another example would be $\frac{5}{8}$-in. work across a $2\frac{1}{4} \times 12\frac{1}{2}$-in.

slab in a vertical edger of 12-in. skelp mill, where groove bottoms are 14-in. in diam. Every bit of furnace scale is broken away at this pass.

The so-called Canadian ragging on hot strip mills further breaks up any chance remaining pieces of scale, with one of the types of hydraulic sprays then washing it away. Then there is the matter of rolled-in ingot scale which occurs when slabbing or blooming mill practices are not as effective as customarily in its removal from the slab surface. Slabs are usually piled one on top of another, as in a piler, and such scale then becomes "baked" in, making it a highly difficult matter to remove in subsequent mills.

Some years ago, tests were conducted on various pressures of cooling water on rolls. As recalled, the most efficient were around 60 to 70 psi. Line pressure of 40 psi did not wash off adhering secondary scale, although it was effective as a medium for roll cooling. At 80 psi and above, the applied water "bounced" off the surface and cleaned the roll, but was not as efficient in carrying off heat. This is pertinent to the subject under discussion, for the composition of scale varies, some of it being characteristically adhering and hard, while some are "gummy," with a tendency to cling to the roll surface. Therefore, each revolution of the roll adds to surface damage, even though the scale does not build up (it sometimes does so). In cases of this kind, the scale particles going around with the roll are pressed into the bar at the entering side. By this, the entered bar itself becomes the agent which cleans the roll, although adding another deposit on the delivery side to go around again and be picked up by the next bar. Some finishing stands of hot strip mills use 100 psi cooling water, directing it against the work rolls to prevent "bouncing" and in sufficient volume to remove all secondary or powdery scale as well as to cool.

This commentator recently gave a paper which touched upon cooling water applications to rod mill rolls, with emphasis on applying it at the delivery side. This phase of prolonging roll pass life is intimately connected with Mr. Lambert's subject.

Mr. Lambert's paper ably describes the effectiveness and methods of scale removal by hydraulic water. Whatever the method or combinations, it all adds up to removing scale before the next roll or pass can further press it into the matrix of the rolled bar's surface. It reflects the efforts of the industry, in which his company plays such an important part, and himself, in serving the consumers of steel with surfaces free of defects.

H. E. Muller: Without a doubt, descaling practices similar to those described are applicable to the operations of other producers. The mechanics of the impinging water jet is worthy of some theoretical consideration. Neglecting thermal effects, the active force of the water is proportional to the change in momentum of the water. Momentum is a property described as the product of mass and velocity or simply MV in mathematical notation.

A vector diagram of the velocities involved in the situation of a jet striking a moving bar in the plane of the bar would appear as shown in Figure 13. It is quite evident that the normal velocity component is the one responsible for the scale breaking action. The tangential component serves to entrain the scale and sweep it away. In addition, the sweeping action also causes a pressure build up in scale pockets, aiding in the loosening of clinging particles.

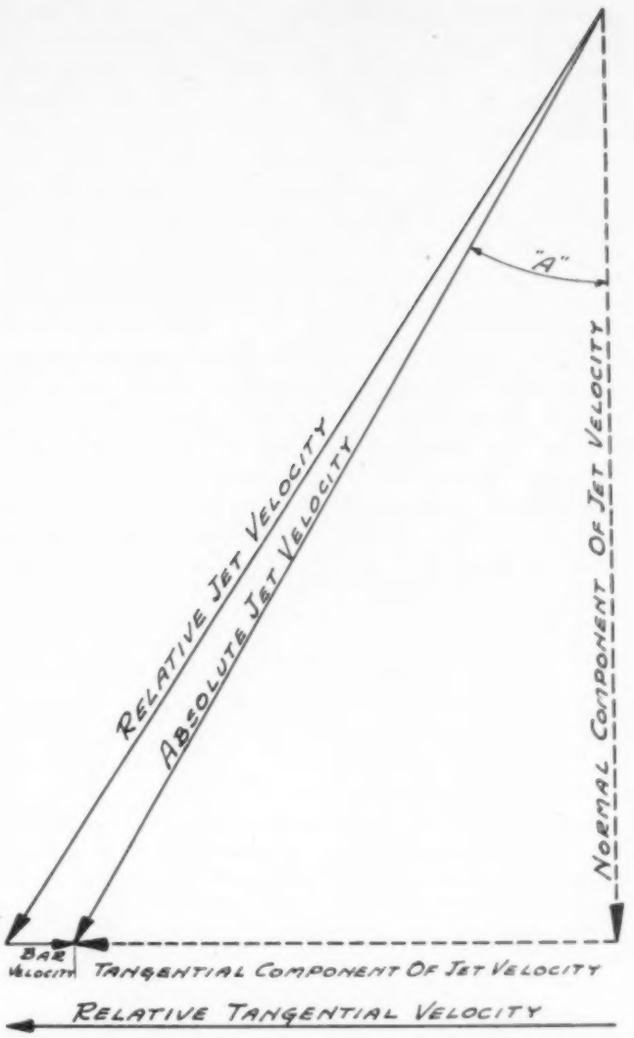


Figure 13 — Approach velocity vectors of hydraulic jet and moving bar.

The angle indicated by the letter A should, therefore, be regulated according to the results desired. If a maximum scale breaking force is desired, the angle should be small. On the other hand, if a larger tangential action is in order the angle should be increased.

Evidently there are many variables entering into this relationship; velocity, angularity, orifice size, shape of orifice and pressure. Optimum working conditions are found by trial and error in most cases. However, it does no harm to consider theoretical aspects. Thereby, often times, the number of trials can be reduced because a quicker convergance of significant data can be obtained.

Clayton L. Squier: I would like to ask how the spray is turned on as the bar approaches the stand; is it done manually, with a flag switch, or a photo-electric cell? We have had a problem developing a good means of initiating the spray valves.

C. S. Lambert: These sprays are on continuously. Water is only shut off for changes or stickers in the mill.

Member: I would like to know what kind of strainer is used?

C. S. Lambert: We are using a rotary screen that takes a lot of the large particles out of the river water. It is a self-cleaning screen.

COIL

. . . . because of variations in coil size, the single stack annealing furnace gives economy . . . . because of better control, it gives better quality . . . .

▲ AMERICANS love to build big — big skyscrapers — big locomotives — big airplanes — big automobiles — big open hearths — big steel mills — in fact, most of us feel we are in some way related to Paul Bunyan and love to outdo his feats. There are times and places, however, when things can be built too big. In fact, excessive size sometimes results in mediocre quality or inaccurate control or inefficient load factors. You may remember the 70-ton German tanks which were so enormous that they broke down all normal bridges and finally were abandoned because of their tremendous size and lack of maneuverability.

Has our desire for bigness, our Paul Bunyan ancestry, caused us to sacrifice quality, efficiency and flexibility in some of our annealing departments?

Just before the last war when steel still had to be sold, high quality and low cost of manufacture were absolute necessities. Companies that could not produce on this basis either lost money or went out of business. During the competitive period, the largest annealing cover we knew of in the world had a maximum capacity of 75-tons per charge. The average was about 40-tons per charge.

Today, we have covers that will take a 600-ton charge (Figure 1) at one time. The advantages of these tremendous covers are supposed to be:

1. Low cost fuel.
2. Low investment cost.
3. Lower labor costs.

During the past year we have made a careful analysis comparing multiple-stack covers with portable base single-stack covers and have found in every case that the portable base single-stack cover was:

1. Lower in first cost.
2. Lower in fuel cost.
3. Equal in labor cost.
4. Lower in maintenance costs.
5. Produced a better quality product in a shorter time.

How can portable-base single-stack furnaces be lower in first cost?

1. Fewer stands are required.
2. No basements are needed.
3. Smaller cranes and lighter building are used.
4. Less floor space is required.

Records show that comparing single-stack furnaces with multiple-stack units, the single-stack furnaces produce roughly two times as much tonnage per stack as multiple-stack units do. The reason for this larger tonnage can be traced to two things, first, the much greater radiating capacity that it is possible to build into the single-stack furnaces, and second, the load factor of single-stack furnaces is excellent, and normally can be considered to be about 90 per cent, while in multiple-stack furnaces it varies from around 70 per cent in 4-stack furnaces to about 60 per cent in 8-stack furnaces.

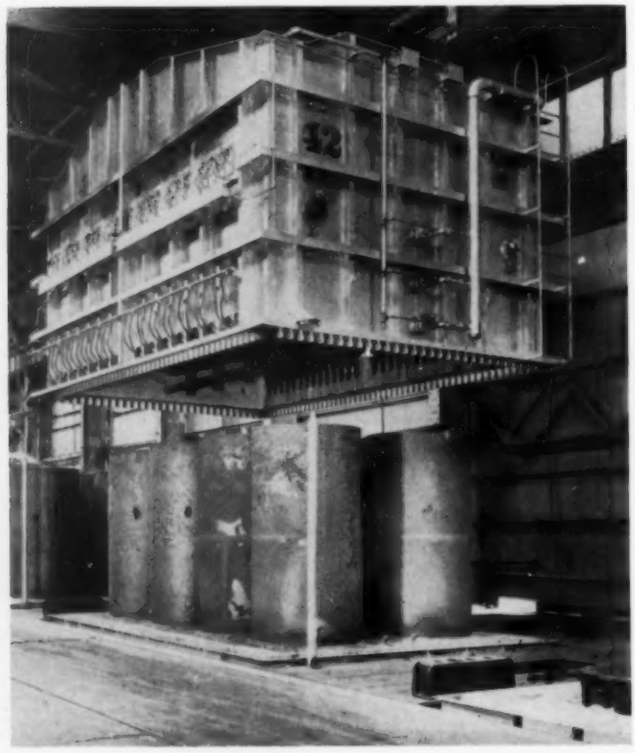
The capacity to heat any given stack of steel is almost completely dependent upon the square feet of radiation that it is possible to group around the bottom of the stack. Adding radiation at the top of the stack is not helpful, but adding radiation to the bottom of the stack, of course, greatly speeds up the heating of the coils.

In multiple-stack furnaces we have all been trying for years to find some way of applying tubes to all four sides of the coils. Figure 3 shows the typical multiple-stack unit. As can be seen, the tubes can be placed along the sidewalls, or they can be placed crosswise in the furnace as in Figure 4, but no one has found any way of placing sufficient tubes both on the sidewalls and crosswise at the same time.

On single-stack furnaces, it is possible to place the tubes equi-distant from the coils completely surrounding the inner cover as shown in Figure 5, and thereby obtain double the amount of radiation in the bottom of the furnace. This, of course, not only produces much faster heating, but also much more uniform heating. One of the inherent difficulties with multiple-stack furnaces is the fact that the inner covers are heated on two sides only, and eventually become square or rectangular in shape unless they are carefully rotated.

Another factor which is overlooked in considering multiple and single-stack furnaces is that when there are twice as many tubes in a furnace, twice as much fuel can be burnt thereby releasing twice as many Btu and giving much higher heating rates. In an 8-stack furnace, it is very difficult to get more than 16,000,000

Figure 1 — Typical 8-stack furnace shown is used for charges up to 600 tons.



ANNEALING

By LEE WILSON

Lee Wilson Engineering Co.

Cleveland, Ohio

Btu total capacity in the furnace, and still have it applied around the bottom of the furnace where it will be useful. This, of course, turns out to be 2,000,000 Btu per stack. In a single-stack furnace, it is entirely possible to get as high as 6,000,000 Btu per stack. In other words, supplying 12 vertical tubes with 400,000 Btu per tube is a common procedure. In a 4-stack furnace in which there are tubes of equal size on both sides of the coils it is possible to get as high as 3,000,000 Btu per stack. This gives a comparison between the heating rates of 8-stack furnaces with a maximum Btu release of 2,000,000 Btu per stack, and a single-stack furnace with a maximum of 6,000,000 Btu per stack.

So it can be easily seen from these figures why it is possible to heat with single-stack furnaces so much faster and so much more uniformly than with multiple-stack furnaces.

The necessity of applying the heat to the bottom of the furnace rather than adding it to the top has been mentioned several times. Of course, it is apparent why this is true; however, it is worth a little further discussion. It is commonly felt that the reason the top of the furnace heats more rapidly than the bottom is because the heat naturally goes up. This is literally true, but for a different reason than is sometimes supposed. There is no doubt that the convection currents in a furnace carry the heat to the top; however, in a radiant tube furnace, the convection currents other than those created by the circulating fan are not of too much importance. It is the inner cover which causes the great difficulty. The inner cover is, of course, the primary radiating surface as far as the coil itself is concerned. All of the heat that is transmitted to the coil by radiation comes directly from the inner cover. The inner cover, made of steel, is one of the best known heat conducting materials. Heat applied to the outside of the inner cover immediately diffuses itself at a very rapid rate to all parts of the inner cover which are lower in temperature. For example, if 1,000,000 Btu are applied around the bottom of the inner cover and none are applied at the top, some of the heat will be conducted up the inner cover at a terrific rate and be diffused to the upper part.

When one considers the shape of the inner cover and its relation to the pile of coils or stand of coils as is shown in Figure 6, it is seen that the bottom coil is subjected to a band of inner cover radiation approximately the same width as the coil is high. For instance, if we have a coil, 3 ft high and 6 ft in diam, the band of radiation would be roughly 60 sq ft. Now what happens with the top coil? The top coil has also 60 sq ft of radiation on the sides, and if the coil does not go clear to the top of the inner cover, the radiation is increased by the empty space above the coil so that it could be more than 60 sq ft. But in addition, the top or dome of the inner cover is added to this amount, and it has roughly 42 sq ft of radiation so the top coil is subjected to a radiating surface of 60 plus 42 sq ft, or a total of 102 sq ft or more. There is no wonder that the top coil heats so much more rapidly than the others, unless something is done to counteract or balance this condition. There are several things to do. We apply higher temperatures at the bottom of the furnace so that the 60 sq ft instead of having a temperature of 1400 F has a temperature of 1600 F thereby trying to equalize the amount of heat that can be applied to the bottom coil. This is a difficult situation, however, because if we apply a higher temperature at the bottom, the heat runs up the inner cover to the top just that much faster so the gain is not as great as is desirable. The other method is to apply twice as much radiation to the inner cover at the bottom, and this is then considerably better. In that way, it is possible to bring the lower part of the inner cover up to a higher temperature without bringing the top up proportionately. In other words, if there is twice as much tube radiation at the bottom, the bottom is brought up perhaps 50 per cent faster than it would be possible to do if we ran half as many tubes at much higher temperature.

From this discussion, it can be seen how very important it is to have ample radiation at the bottom of the furnace. High temperature tubes or other sources of high temperature heat working on the inner cover are not the answer. They only distort the inner cover and abuse the burners, furnace walls, or tubes. The right answer is twice as much area of radiation at the bottom of the furnace operating at a normal safe temperature.

The problem of furnace loading is of utmost importance in annealing steel because of the fact that different

Figure 2 — Single stack, portable base, high convection annealing furnaces are very flexible in operation.

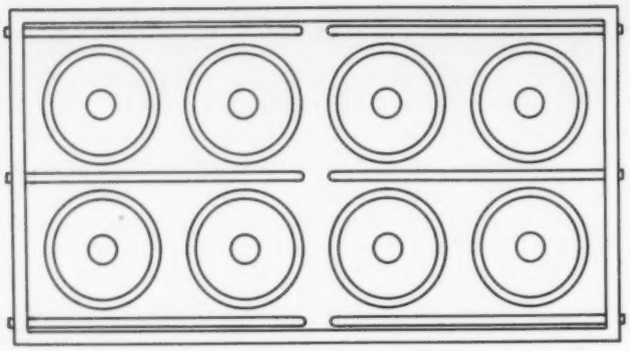
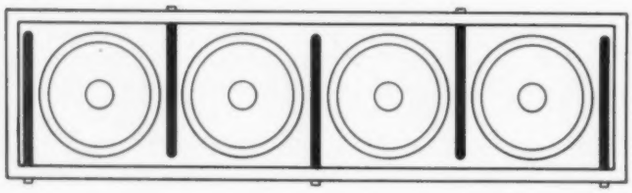


Figure 3 — It is very difficult to place tubes both crosswise and along the sidewalls in multiple stack furnaces.

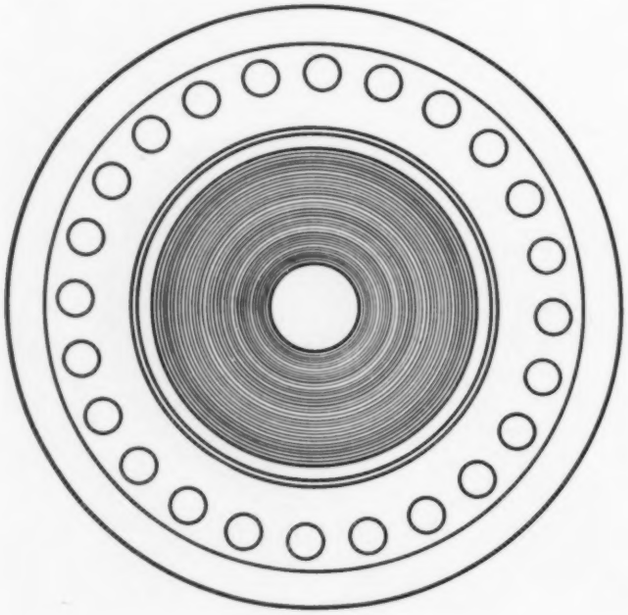
Figure 4 — Tubes shown are placed crosswise in this 4-stack furnace.



size coils require different times to anneal. For instance, a coil having a weight of 10 tons and a diameter of 60 in. requires roughly half of the time to anneal that a coil weighing 20 tons and a greater diameter. Many times, it is impossible to get even 4 coils for one stand that are all of equal weight and size. The possibility of having sufficient coils of the same size to uniformly load a 4 or 8-stack furnace is most remote in the average cold strip mill today. In fact, walking through annealing departments, one is struck with non-uniformity of multiple-stack loading.

Figure 7 shows what happens in a multiple-stack

Figure 5 — In the single stack unit, the tubes can be positioned to completely surround the coil.



furnace when we do not have uniform loading. It can be easily seen that the small stack, which say weighs a total of 23 tons, would have a certain best heating rate. In other words, if this could be heated at its best heating rate, it would probably take about 17 hours to heat and soak to complete saturation. Once it has come up to its maximum allowable temperature of about 1300 F, it should be held at that temperature and not allowed to exceed it or the material will stick or get excessive grain size. However, down the line is a stack of coils which weighs 39 tons. Now this stack would have a normal heating time of probably 28-30 hours depending upon the type of furnace, but at any rate the relationship between heating the small stack and the big stack would be something like 17 to 30. However, the big stack will take longer in this case because the furnace is being held back to keep from over-heating stack No. 1, and actually it will probably stretch out somewhere between 34-36 hours. Now see what is happening here. Unnecessary time is added to the big stack and the small stack is being held in the furnace twice as long as we should. Leaving steel in a furnace twice as long as it should be held wastes fuel, wastes floor space, and wastes furnace capacity. Figure 8 shows what would happen in this furnace if each one of these stacks were individually controlled. On the first stand, two 23-ton stacks would be annealed in 34 hours and that stand would have double the production. The big stand would be finished in 28 hours instead of 34, so the production of that stand would be increased by some 15 per cent. And this operation goes right on down through the whole charge. Some you would increase 15 per cent, some you would increase 50 per cent, and in the case of No. 1 stand, you would increase 100 per cent. The average increase would be in the neighborhood of 50 per cent. Furthermore, the metallurgical department would not have any of the difficulties that they now have in trying to determine which parts of the charge were overheated and which parts were underheated. They would know that each stack had been subjected to a controlled heat during its entire heating period.

Now the problem of cooling enters into this load factor just as much as heating. We all know that to cool a 39-ton charge is going to require much longer than to cool a 23-ton charge; but we have to wait for the big stack to cool. The little stack should have been out and in the customer's plant by the time it actually gets out of the furnace. So we have a very inefficient method of cooling because it is impossible in large multiple-stack furnaces to schedule orders so that you charge the furnace with uniform stacks.

Now with single-stack furnaces, this condition does not exist to nearly as great an extent. It still exists to a small extent. It is still impossible to always get three or four coils of equal size, in which case you still have to hold the furnace back because of the small coil and wait for some of the big coils. We have found a load factor of about 90 per cent for single-stack furnaces, 70 per cent for 4-stack furnaces, and 60 per cent for 8-stack furnaces. You, in your own plant, can best analyze this situation and arrive at your actual load factors.

Now if the analysis holds true that a single-stack furnace has a load factor of 90 per cent and an 8-stack furnace has a load factor of 60 per cent, then a single-stack furnace will produce 50 per cent more tonnage per

stack than an 8-stack unit due to load factor. Remembering that it is possible to apply twice as much radiation around the bottom of a single-stack furnace and get a 50 per cent increase in tonnage, it is found that there is a total of 100 per cent increase.

In a number of places, it has been proven that multiple-stack furnaces average a ton per stand per hour, while single-stack furnaces will produce two tons per stand per hour without any difficulty on monthly figures. One of the things that has been confusing is the fact that single-stack furnaces with equal charges will only produce about 50 per cent more tonnage from a heating standpoint than multiple-stack furnaces. When you take the monthly average which takes into account the load factor, they actually produce 100 per cent more tonnage. With this increase in tonnage, it is easy to see why they require less floor space.

With single-stack furnace, it is possible to build, in addition to a portable furnace, a portable base shown in Figure 9. All of our recent installations have been built to that design. The base is made just as portable as the furnace. Quick connectors are used for electricity, thermocouples, and deoxidizing gas in the portable base, just as they are used in a portable cover. Guide cones are used which match the cover guide posts.

To repair or inspect a portable base it is only necessary to disconnect three connectors to pick up the base and take it to a maintenance station where any repair and maintenance work can be done. An extra base is kept on hand to substitute for the base being repaired. Thus it is a matter of perhaps 15 minutes to make a change.

Operating and maintenance departments have been very enthusiastic about this method of base maintenance. The maintenance departments do not have to work in unhandy basements with low headroom. They can always have their proper tools and equipment handy together with necessary cranes to facilitate their work. Maintenance costs are much lower as a result. The operating departments like it because the furnace is not out of production, even though maintenance work is being done on the base. By having one or two extra bases which could be called "floaters," it is possible to always have 100 per cent furnace operation.

Compare this now with an 8-stack base. If there are difficulties on an 8-stack base, there is a complete shutdown of 8 stands which would mean a loss of 5 to 8 tons of annealing capacity per hour. See Figure 10.

The portable base eliminates the necessity for putting basements under cover type furnaces and, of course, this saves tremendous sums of money in new annealing departments. The steel supporting structure, the extra concrete work involved, problems of pumping water from basements below ground level, the added expense of keeping basements clean and fireproof, and all of the other troubles which basements under furnaces create are eliminated by the portable base. It is no wonder that the last three large jobs we have sold, both in this country and abroad, have all been single-stack portable base units.

A single-stack furnace, of course, only weighs around 15 tons maximum and can be handled by a 15 or 20-ton crane. With small cranes, a much lighter building structure can be used which eliminates considerable of the first cost. The speed of the crane can also be much greater which adds to the mobility and speed with which coils and furnaces can be handled. Another big advantage, of course, is the fact that maintenance on small cranes is much less in cost and time than maintenance on large cranes.

Portable base single-stack furnaces require less floor space normally than do multiple-stack furnaces because they have fewer stands due to faster heating and cooling and better load factors. Furthermore, inner cover storage can be taken care of between the furnaces and additional space does not have to be allowed. See

Figure 6 — The top coil is subjected to more radiation than the bottom coil.

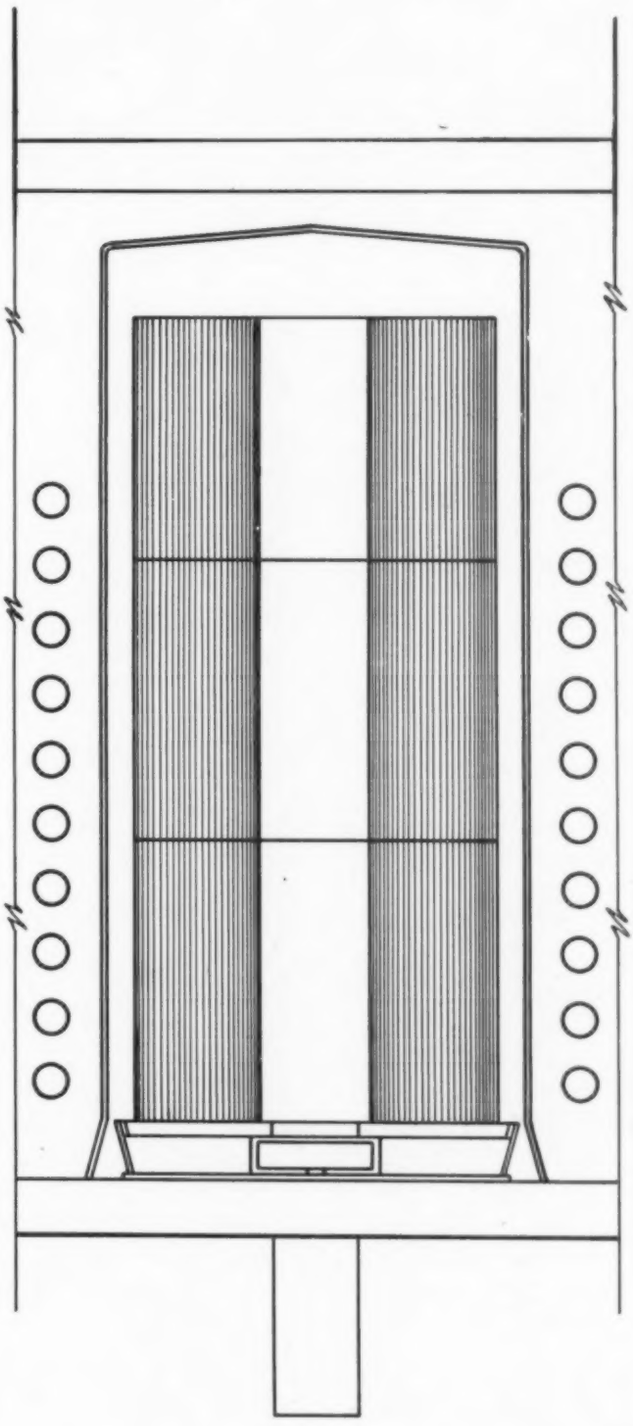


Figure 11. In some cases we have found as much as 20 per cent floor space saving by the use of portable base single-stack furnaces as compared to 4-stack covers.

In summing up why portable base single-stack furnaces cost less than multiple-stack furnaces, there are four reasons. First, fewer stands are required, no basements are needed, smaller cranes and lighter buildings are used, and normally less floor space is required. All of these advantages added together really represent many dollars of savings. Oftentimes these savings amount to as much as 20 per cent of the overall first cost.

There has been a lot said about the possibilities of obtaining lower fuel costs with larger furnaces, and there is no question that if a large furnace could be built and operated with as high a load factor and as an efficient heating source as a small furnace, it would be more economical on fuel. However, take a quick look at a multiple-stack furnace compared to a single-stack furnace. First of all, there are a great many more square feet of radiating tubes in a single-stack furnace with the result that the tubes can be operated at a lower uniform temperature thereby getting a lower flue-gas temperature. Of course, lower flue-gas temperatures mean greater economy, so from a standpoint of flue-gas temperatures, single-stack furnaces would be more efficient.

Portable base single-stack furnaces produce twice as much steel per stand as 8-stand furnaces. The square feet of radiation loss on four single-stack furnaces is less than the loss on one large 8-stand furnace.

So if the lower flue-gas temperatures, shorter heating times in single-stack portable base furnaces, much higher load factor are considered, the fuel cost rather than being higher is found actually lower except in those cases where multiple-stack furnaces can always be operated at 90 per cent load factors.

Another point which has been stressed in the past is that of labor costs. We are going to load the same number of coils, the same number of convectors and the same number of inner covers, and although it may be easier to load single-stack furnaces because the stands are accessible and easier for the crane operator to see, assume that these costs are equal. Now the question comes as to whether it is more expensive to handle one large furnace or several small ones. Table I analyzes

TABLE I

CRANE MOVES TO ANNEAL 1000 TONS PER MONTH

	8-Stack	4-Stack	1-Stack
Crane moves —			
Coils (3 Coils loading, 3 Coils unloading)	150	150	150
Convectors (2 Convectors loading, 2 Convectors unloading)	100	100	100
Inner covers — 1 per stack	25	25	25
Furnace moves	3	6	25
	278	281	300
Moves saved per month	22	19	0

Average Tons Per Stand 40
Average Stacks Per Month 25

the number of moves made with a crane to anneal 1000 tons per month with an average charge of 40 tons

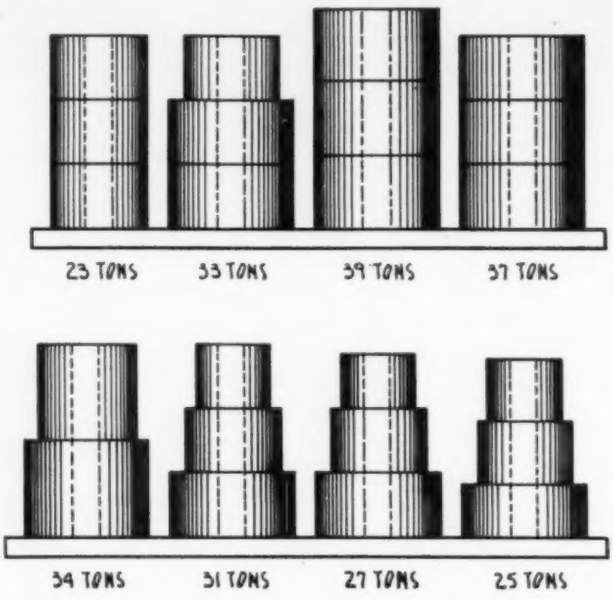


Figure 7 — Typical piling for an 8-stack furnace using a time of 44 hr. Time is set by larger coils.

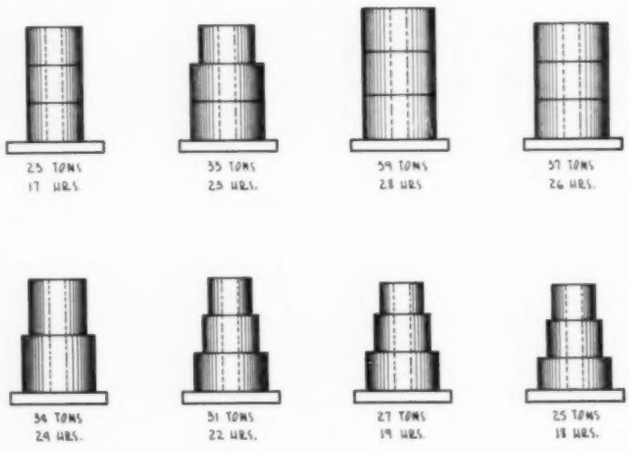
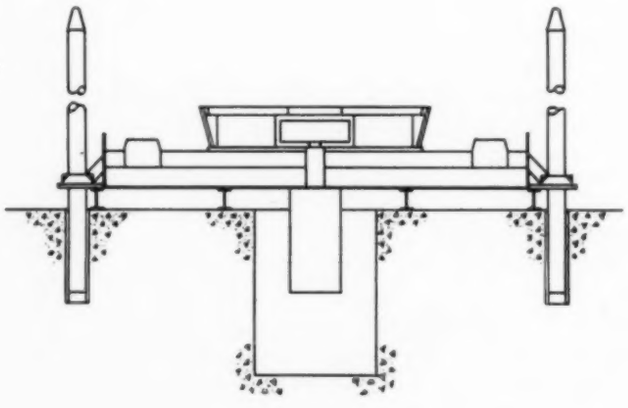


Figure 8 — Typical piling in single stack furnace. Time of annealing is set to give the best results for each individual stack.

Figure 9 — Portable bases can be easily built for single stack units.



per stand. We have to have twenty-five 40-ton stacks to make 1000 tons of steel per month; so if we analyze it, the crane has certain definite moves to make. For instance, in loading 25 stacks, with an average of 3 coils per stack, we will have 75 moves to load the coils and 75 moves to unload or a total of 150 moves whether we are charging an 8-stack furnace, a 4-stack furnace, or single-stack furnace. There are also 2 convectors per stack to handle. Two times 25 stacks is 50, and unloading is 50 more, or a total of 100 moves whether we are considering 8, 4, or single-stack furnaces. There is also one inner cover for each stack, so there is a total of 25 inner covers for any one of the three size units. Now as far as furnace moves are concerned, with the 8-stack there is a total of 3 very large 75-ton furnaces to move; with a 4-stack there are 6 furnaces of considerably less weight, and in the case of the single-stack furnaces, there are 25 very small light-weight furnaces to handle, which in all probability can be handled with the same crane equipment that has been handling inner covers and coils.

So looking at the totals, there is for the 8-stack furnace a total number of 278 moves; for the 4-stack, 281; for the single-stack 300. In other words, with the 8-stack furnaces, there is saved 22 out of 300 moves, or less than one move per day. With the 4-stack furnace, there is saved 19 out of 300 moves, but actually in our opinion more than this amount of time is saved in the easier handling of the furnaces and inner covers and the ability to handle small furnaces without having to change gear and use extremely slow cumbersome crane equipment. Most operators, after analyzing the situation as it is shown above, decide that their annealing department could well afford one added move per day to get the advantages of the smaller furnaces.

The labor of moving furnaces is such a very small percentage of the total labor of charging furnaces that actually there is practically no difference in labor for single-stack, 4-stack, or 8-stack furnaces.

One item which becomes more and more troublesome as the equipment gets more complicated, such as convector furnaces, is the problem of maintenance. When hot circulating fans are added to give better production and better quality, a piece of equipment is being added which is a necessary maintenance item. Furthermore, unfortunately none of the folks designing annealing equipment have found any better place to put circulating fans than right down underneath the center of the entire load, and every time a crane operator loads a coil and lets it swing sidewise a little bit or drops it an inch, he is giving the whole bottom structure a terrific twist or impact load.

The problem of maintaining portable base single-stack furnaces is a great deal easier than that of maintaining large cumbersome furnaces with fixed bases. Take for example, an annealing department that has six 8-stack furnaces as compared to one which would produce about the same amount of tonnage with 25 single-stack furnaces. It is relatively inexpensive to have an extra single-stack furnace which can always be kept in a state of repair. In case of any maintenance difficulties, we just switch to the spare furnace and move the one which is in need of repair to the maintenance section. The same is true of the bases. We would have, perhaps in this case, two floating bases so that it would always

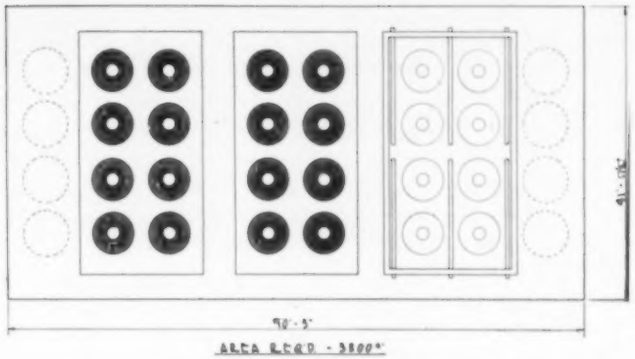


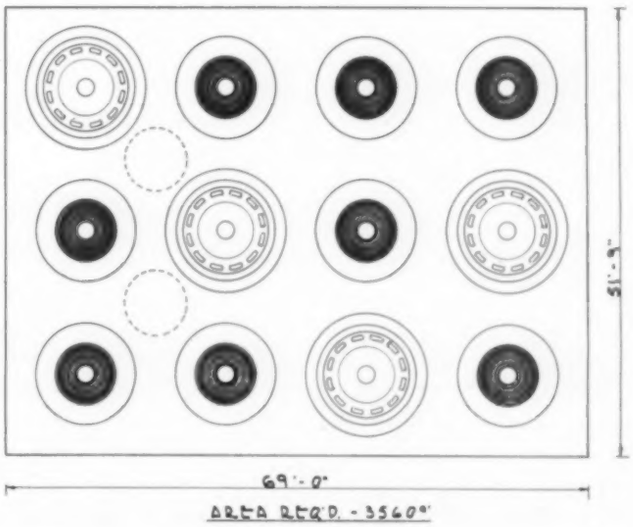
Figure 10 — Multiple stack units require more floor area.

be possible to have one in perfect condition ready to substitute for the one needing attention. Certainly maintenance men will appreciate the advantage of having a shop where they can do their maintenance work, and certainly production people will recognize the advantage of not having to tie up a large percentage of their production equipment for maintenance.

Consider the possible production loss if an 8-stack furnace or base is out of order. If there is an extra 8-stack swing furnace, the first cost is prohibitive by comparison. Extra bases of the non-portable type are expensive and take up valuable floor space. Actually, with portable base single-stack equipment, one swing furnace and two swing bases will assure a maximum of production. These things are important from the standpoint of cost, production and quality.

Now the last question is one in which all are widely interested — the question of *quality*. It is certain that if the metallurgists could have exactly what they wanted, they would like to have individual temperature control over each coil of steel that was annealed. In fact, many metallurgists say that they want continuous annealing of steel because then each square foot of steel would get exactly the same controlled treatment. The simple method of proving that better quality can be

Figure 11 — Additional space need not be allowed for single stack units for maintenance and repair.



produced in single-stack furnaces is to point out that each single-stack furnace has complete temperature control, each stack, in other words, is a unit in itself.

Each stack is controlled to the best possible advantage for that stack. In a 2-stack furnace, there is a condition only half as good; one stack is properly controlled, but the other one has to be done by guess. In a 4-stack furnace, the condition is only one-fourth as good. There is, in this case, one stack which can be controlled and another stack which has to be nursed. In other words, with a little stack we bring it up as fast as we can until it begins to overheat, and then we switch to the big stack and hold back so as not to hurt the little one. What happens to the two intermediate stacks is anyone's guess. Then with the 8-stack furnace, we have a condition which is most difficult to contend with because we have a small stack which we must not overheat, and a large stack which we must somehow get hot. What happens to the other 6 stacks is unknown. There is still another factor which is important. In a single-stack furnace, the heat is evenly supplied on all sides of the coils. In multiple-stack furnaces, only 2 sides of the coil can be heated. So, in a single-stack furnace there is an ideal condition to produce a uniform temperature on the material being treated. In an 8-stack or 4-stack furnace, heat is being applied uniformly on two sides and it is hoped that the other sides will come up to some temperature which will be satisfactory.

So, this brings us to the end of the five points mentioned in the beginning of the paper; *lower first cost, lower fuel cost, equal labor costs, lower maintenance cost* including less time out of production, and undoubtedly a *product of better quality* produced in a shorter time with portable base single-stack furnaces.

DISCUSSION

PRESENTED BY

H. J. PUGSLEY, Vice President, Swindell-Dressler Corp., Pittsburgh, Pa.

LEE WILSON, Lee Wilson Engineering Co., Cleveland, Ohio

H. J. Pugsley: The trouble we have in many plants is that furnaces are built for 72-in. diam coils, but because of conditions in the plant, available coils are only 54-in. diam. This makes it impossible to have the furnace loaded to capacity. I have been wondering how you get 90 per cent of possible loading where you have a furnace built for 72-in. coils, and the customer is producing 54-in. coils.

Lee Wilson: You are right! We are not familiar with any plant in the United States that produces only one size coil.

Annealing cycles are always dependent on coil size regardless of furnace size. Therefore load factor in a furnace is in direct proportion to the uniformity of the coil sizes in any given charge.

It is easy to get 3 or 4 coils with less than 10 per cent variation in size to fill a single stack furnace. It is nearly impossible to get 25 or 30 coils with less than 30 to 40 per cent variation in size to fill an 8-stack furnace.

PLAN TO ATTEND

AISE SPRING CONFERENCE

NETHERLAND PLAZA HOTEL

CINCINNATI, OHIO

APRIL 28 - 29, 1952

Selection and Maintenance of Wire Rope

By W. I. LEX
Assistant Chief Engineer
Wire Rope Engineering Div.
John A. Roebling's Sons Co.
Trenton, N. J.

. . . . variations in wire rope designs and constructions arise from the many different applications for which they are engineered . . . .

▲ TO deal intelligently with any subject concerning the selection and maintenance of wire rope, some description and definitions should first be given of this material. Wire rope is a precision product and an extremely reliable structural material. It is made of carefully selected steel wires which have been cold drawn to very close tolerances and made to meet rigid physical and chemical requirements.

The ingredients that go into the manufacture of a wire rope are few. They consist of wire, lubricant, and sometimes fiber for the center or core. However, the processing of the steel to produce wire of the necessary quality to make a good wire rope is complicated and involves dozens of steps.

In our plant we start by making our own steel in small open hearth furnaces of approximately 40 tons capacity. Most open hearth furnaces today are considerably larger than this, but we have always felt that by making smaller quantities of steel the desired physical and chemical properties of the finished product can be better controlled.

The ingots are hot rolled in the blooming mill to 2 by 2-in. billets and these are again heated so that they can be rolled into rod. Rods for wire rope are rolled in a continuous automatic rod mill where they are reduced by hot work to a circular section. As they emerge from this mill, the rods are in coils and this represents the last hot work performed on the product.

In making this rod into wire, a series of heat treating, cleaning, and cold working processes are necessary. As a typical example of the way in which a certain wire is made, the rod from the blooming mill is first taken to the cleaning house where the scale or oxide which has formed on it due to hot work is removed. After the rod has been cleaned and subjected to a baking process, it is taken to the wire mill where it is drawn through dies which reduces it in section. At the same time the wire becomes elongated, and during this cold working process, strength and toughness are imparted to it.

After several reductions, it is necessary to give the wire a heat treatment which relieves the stresses resulting from cold work and allows us to draw the wire to still smaller diameters.

The number of holes that each wire can be drawn, how and at what time during the drawing process it must be given heat treatment, depends upon the type of wire being made and the rope in which it is to be used. Many times the wire must make several complete cycles through the wire mills, heat treating departments, and cleaning houses before it is ready to be fabricated into rope.

Each coil of wire in its finished form has a sample taken from the end to be tested for tensile strength, elongation, and torsion. Rigid physical as well as chemical requirements must be met by rope wire, and the sample from each coil must comply with the necessary specifications before the wire is shipped to the rope shop.

Wire which is used in the fabrication of wire rope has a tensile strength in the magnitude of about 225,000 to 250,000 psi. In the case of some wire rope, higher strength wire is used and in some cases the tensile strength is somewhat less. This high tensile strength is obtained by cold drawing, and at the same time the steel gains toughness and fatigue resistance necessary to withstand the severe conditions of operation a finished rope is generally called upon to perform. The manufacture of the wire is extremely important because if this material is not homogeneous and uniform, and if it does not have the proper physical characteristics, the fabrication of the rope no matter how carefully performed cannot possibly result in a finished product of the desired quality.

It is not my purpose here to describe in any more detail the manufacture of rope wire, nor do I intend to dwell at any length on a description of the other ingredients which must be used in making wire rope. I wish to merely mention that lubricant is used for two primary reasons; first as a lubricant to the rope, and, second as protection. Wire rope is made of many separate elements and the flexibility of the finished product depends to a large degree upon the ability of these

elements to move with respect to each other when the rope is bent around a sheave or a drum. Lubrication is necessary so that this relative movement can occur with as little friction as possible, and it will always be found that the better the lubricated condition of the rope throughout its life, the better will be its performance.

Lubricant is applied during manufacture also since protection against corrosion is necessary during storage and shipment. Naturally to afford the greatest degree of protection, a heavier type of lubricant must be used and thus the type of lubricant applied during manufacture depends to a large extent upon the known service to which the rope will be subjected in the field. In the case of ropes which are to be operated indoors, such as elevator ropes and overhead traveling crane ropes, a thinner type of material which has good lubricating qualities is used. This lubricant has sufficient protection to prevent corrosion during shipment, but it would not protect the rope very long if it had to operate out in the weather. An entirely different type of lubricant is applied to ropes which are fabricated for dredges and shaft hoist service in wet mines since here the main problem is protection against corrosion. Naturally a considerable number of different lubricants must be used between these two extremes, and in every case the lubricant is made suitable for the known end use of the wire rope.

Some wire ropes are all metallic in construction and no other material is used in the manufacture. Many however are constructed with a fibre core and generally this core is in the form of a small rope made of sisal fibers, sometimes referred to as a hemp center. The primary purpose of the core is to support the steel strands of the rope in a proper position relative to the other strands of the rope. The fiber core is lubricated, but this lubricant is mainly for protection and self-preservation.

In fabricating the wire rope, a group of wires is first laid together spiraly in one or more layers around a center wire to form a definite pattern which is called a "strand." I use the word "laid" and not "twisted," because the stranding machine operates in just this manner. Next, six or eight strands or in some cases, a greater number of strands, are laid or closed together around the core to form the finished rope.

In describing wire rope we often use the word "construction." We talk of the construction in which the rope is fabricated, and we also talk of the construction of rope which should be used for various types of service. Construction denotes the number of wires and strands in the rope, the type of core which is used, and the way in which these are put together to form the finished product. There are many different strand constructions in common use today, ranging from those containing 7 wires to those having 61 wires or even more. These strands can be formed into a 6-or-8 strand rope. The rope can have either a fiber or a metallic core. It can be right or left lay, and it can be regular or lang lay. Then in addition to all these combinations it can be either preformed or non-preformed. Thus there are literally hundreds of different rope constructions, and when it is remembered that there are various grades in which each can be furnished, and many different sizes, it can be seen that the manufacturer today must make literally thousands of different ropes.

Why are so many different type ropes necessary? The answer lies in the fact that almost every job in the field differs in some respect from every other job, and a rope that performs most satisfactorily in one case may not be best suited in another. It is our job to design and furnish the type of rope that will give the best service in each and every case.

6x7 Classification—There are four classifications in which the ropes in most common use can be grouped. These are the 6x7, 6x19, 8x19 and 6x37 types of rope. In each case, the first number applies to the number of strands in the rope and the second, the approximate number of wires in each strand. The word "approximate" is used because these classifications merely designate price and strength groupings and generally they include rope which may actually have different numbers of wires per strand than the designation indicates. For instance, ropes in the 6x19 classification include constructions having from 16 wires to as many as 25 wires in each strand.

In the 6x7 construction there are six strands each containing seven wires laid around the core of the rope. This construction is often referred to as the coarse laid construction, since the rope contains a relatively few number of large diameter wires. It is suitable for guys and standing rope where bending is not required, and it is very well suited to some operations where considerable resistance to abrasion or corrosion is necessary. However, it is a fairly stiff rope, and where bending is required, the diameter of the sheaves and drums over which it operates should be very large.

6x19 Classification—As previously mentioned, there are several different rope constructions which fall within this classification and they vary in flexibility, depending upon the exact number of wires used in each of the strands. In general, however, ropes in this classification are much more flexible than those of the 6x7 classification, and as a matter of fact this type of rope combines resistance to bending fatigue and resistance to abrasion to about equal degree. It is used for most general hoisting purposes, and more of this construction is employed than any of the other rope constructions.

8x19 Classification—The 8x19 classification results in a rope which is more flexible than the 6x19 type since it contains more strands, each slightly smaller in diameter. It has less metallic area than the 6x19 rope, however, and the core of the rope is slightly larger in diameter. Therefore it does not have the same strength as the 6x19, nor does it have the same resistance to crushing and distortion, and its applications in the industrial field are very few. Its widest field is for use on elevators where the conditions of operation are fairly easy, and where the greater flexibility of this type of rope can be used to advantage.

6x37 Classification—Of the ropes fabricated with six strands, the 6x37 classification represents the most flexible group. Again a wide variety of constructions are made under this classification, and individual strands may have as few as 26 or as many as 46 wires. Since a larger number of wires are used, they are naturally smaller in diameter than in the case of 6x19 rope, and

they therefore have much less resistance to abrasion and scrubbing. The greater flexibility of this rope, however, lends itself well to those installations where the sheaves and drums are small and the bending requirements are relatively severe.

Right and left lay rope—A right lay rope is one in which the strands are laid around the core in the same direction as the threads in a right-hand screw. The right lay construction is considered standard and unless ropes are specified otherwise, right lay rope is always furnished. There are some few applications which require the use of left lay rope, one being for certain types of water well or oil well drilling where it is desired to use a rope having rotating characteristics which will tend to tighten, rather than loosen the threaded joints of the tools on the end of the rope. There are also a few applications where ropes are used in pairs, and a left lay rope is used in conjunction with a right lay rope to overcome some undesirable rotating tendency. The lay of the rope has some slight influence on its winding characteristics, and in the case of some large shaft hoist installations, left lay rope is employed to improve an abusive drum winding condition. Outside of these few special cases, the lay of the rope has no influence on its operating characteristics, and since right lay is the standard, this construction is generally used because it can be more readily obtained.

Regular and lang lay rope—Wire rope can be fabricated in the lang lay construction as well as the regular lay construction, and the difference here depends upon the direction of the lay of the wires in the strands. When the wires in the strands are laid opposite to the direction in which the strands are laid in the rope, a regular lay construction is formed, and in this case the exposed crowns of the outside wires are practically parallel to the axis of the rope. In the lang lay construction, the wires are laid in the same direction as the lay of the strands, and in this case the outside wires make a considerable angle with the rope axis. Lang lay rope has the same strength as regular lay, but it has the advantage of being slightly more flexible for the same size and strand construction. Also, it has been proven from experience that the lang lay construction has somewhat greater resistance to abrasion than regular lay rope. It is employed for a great many applications in the field of construction and practically all hoist and dragline ropes on excavating equipment and scraper wagons are of the lang lay construction. It is not too well suited to those types of installations where rotation can occur, since the wires and the strands being laid in the same direction offer less resistance to rotation than in the case of a regular lay rope.

Fiber core and independent wire rope core—Any of the various standard constructions of wire rope can be furnished with either a fiber core or a core consisting of an independent wire rope. Originally most ropes were fabricated with fiber core, sometimes called a hemp center, since this type of material was able to withstand the pressures encountered during operation and support the strands of the rope in their proper positions. It is still used in many of our ropes, but there are certain applications that will result in much better operation if a metallic core is used. The trend in the design of many types of equipment today has been towards smaller sheaves and drums and heavier loads, and the pressures which are encountered by the wire rope are far too high for a fiber core to withstand. Thus on practically all types of excavating equipment, on dredges, on winch and car puller ropes, and for many other applications of this nature, a wire rope with independent wire rope core is necessary.

The metallic core of these ropes does add somewhat to the breaking strength of the rope, but generally this is of minor consideration and is only secondary to the main purpose for using this construction.

An independent wire rope core can be used to advantage where such high temperatures are encountered that a fiber core would become charred or burned. If the fiber core collapses and fails to support the strands in their proper positions, the rope will deteriorate rapidly and therefore an independent wire rope core should be used for hoist ropes on hot ladle cranes or for other ropes where high temperatures are encountered.

Preformed and non-preformed rope — A preformed rope is made of the same material as the non-preformed construction, and it can therefore be furnished in any size, grade or construction and as either regular or lang lay. It is made in the same manner as non-preformed rope except that during the final operation, the wires and the strands are formed to the spiral shapes they must assume in the finished rope. Due to this the strands do not have the same tendency to unlay when the rope is cut, and this inert characteristic is what makes a preformed rope readily distinguishable from one of non-preformed construction.

This characteristic makes preformed rope less susceptible to some forms of abuse and less likely to be damaged during installation. The preforming operation makes the rope a little more flexible for the same size and construction, and it is for this reason that better service can be obtained by employing it where bending conditions and fatiguing stresses are severe.

When the rope wears or deteriorates to the point that broken wires commence to appear, there will be another difference between preformed and non-preformed rope that becomes apparent. Since the strands and the wires have been shaped to their spiral forms, the broken ends tend to remain in their original positions and do not spring up from the surface of the rope as they do in the case of the non-preformed construction. Many people seem to be concerned about using preformed rope for fear that it cannot be inspected properly, but from our experience, we have not found this to be the case. It is true that a somewhat different technique may be necessary in making the examination, but we have always found that broken wires occur at the same positions, and can be located if proper care is given at the time of making the examination. We believe that most of the difficulty in the inspection of preformed rope has been encountered by inspectors who have not been aware of the difference in the appearance of the broken wires, and who have expected to feel the breaks with their fingers or have them shown up by running waste over the rope; whereas, they should have made a more careful visual examination.

Grades—The word "grade" refers to the type of steel used in making the rope. There are two different grades known as iron and traction steel which are used in the

elevator field; whereas, there are three grades used in the industrial fields. These are mild plow steel, plow steel and blue center steel or improved plow steel. The different grades have different tensile strengths and thus the breaking strength of the same size and construction of rope varies with the grade. The blue center steel type of rope is the strongest and toughest, and practically every job which a wire rope is called upon to perform in the industrial field today demands the strength and quality of this type of rope. Some ropes in the other two industrial grades are still fabricated, but these are by far the minority and are not worthy of discussion at this time.

Now that we have described the various constructions in which wire ropes are fabricated and mentioned in a very general way the applications of each, we will discuss steel plant installations and give specific rope recommendations for these.

Ropes for derricks and general hoisting purposes—For most applications of this type, a blue center steel rope in the 6x19 classification would be employed, and generally these are regular lay construction, preformed with fiber core. The regular lay would be used to offer resistance to rotation which might occur where a free load was being hoisted. A fiber core would be used if heat were not involved and if the sheave pressures were not excessive. The preformed construction would make the rope more inert, it would add somewhat to its flexibility, and would afford a rope which was less susceptible to damage and abuse while being installed. Naturally for special applications, a somewhat different type of rope might operate to better advantage, but in general this is the construction which is used for this purpose.

Blast furnace hoist—Blast furnace hoist ropes are usually 6x19 blue center steel ropes, preformed with fiber core, and they can be either regular or lang lay. Since one end of these ropes is fastened to a drum and the other is fastened to a load that cannot rotate, the lang lay construction is often used and operates to very good advantage because of its greater flexibility and greater resistance to abrasion.

Winch ropes and car pullers—Again a rope in the 6x19 classification and the blue center steel grade should be used, but since these ropes are subject to abusive drum winding, a regular lay rope with independent wire rope core should be employed. Some flexibility can be gained by using a preformed rope and this feature would also be of benefit since these ropes have to be handled considerably, and a workman is not so apt to injure his hands by broken wires if they do not raise up above the surface of the rope.

Clamshell holding and closing lines—6x19 blue center steel rope, regular lay, preformed, with independent wire rope core is generally specified for this service, and we would point out that the regular lay rope is used to help resist rotation of the bucket. Lang lay rope would be very suitable for this service if it were not for this question of rotation, and even so there are some installations where the bucket does not have to be hoisted very far on which lang lay rope is used with great success.

Ropes for shovel hoist, dragline, boom hoist and scraper wagons—For practically all types of excavating equipment, the 6x19 blue center steel grade, lang lay, preformed with independent wire rope core is used. This is by far the most satisfactory rope for this purpose, and the experience of many years has shown that this type of rope can operate to far better advantage than either the regular lay or the non-preformed rope or one with fiber core.

Overhead traveling crane ropes—For this service, blue center steel ropes in the 6x37 regular lay, fiber core construction are generally employed. These ropes operate indoors so that corrosion is not involved, and as a matter of fact, the only abrasion that is encountered is due to winding over the sheaves and drums. Considerable bending must be encountered by the rope, and the sheave and drum equipment is relatively small; therefore, the flexible 6x37 construction is usually used and quite often these ropes are made preformed to add somewhat to their ability to resist fatigue.

ROPE HANDLING

Having chosen the correct construction of rope for a certain installation, its ability to afford the full measure of service it is capable of rendering depends upon several factors. The equipment on which it is to be used must be of proper design and in a good state of repair. The rope must be handled in such manner that it is not damaged during installation, and after it has been properly installed it must be operated so that it is not subject to overload or other stresses that would cause rapid deterioration. Then it must be maintained properly if it is to give adequate service on the installation in question.

The rules for properly handling a new wire rope and checking the equipment on which it can be used are well known and easy to understand. The importance of avoiding kinks is obvious, and the necessity for making certain that all grooves are of the proper size and contour and do not restrict the rope should need no explanation. The various methods by which a rope can be attached at the end may be of interest, however, and we will describe here the various attachments most commonly employed.

Socket attachment—The socket attachment is one of the oldest and best methods of obtaining a one hundred per cent efficient connection. The straight wire method of socketing rope is recommended for industrial ropes, but it must be performed carefully and properly since its success depends on the wires being securely held in the zinc. The end of the rope which is to go in the basket of the socket is unlaid, and the wires are straightened and cleaned to remove lubricant. The wires are then dipped in acid and held for a sufficient length of time to make sure they are cleaned down to the bare metal. The acid is then removed or neutralized, the wire ends are placed in the socket basket and zinc of the proper temperature is poured into the basket. A bond is actually formed between the zinc and every wire of the rope and when this type of attachment is properly made, it is capable of developing the full tensile strength of the rope.

Swaged attachment—A fitting swaged or pressed on the end of a rope represents another method of obtaining a one hundred per cent attachment. This type of

connection must generally be made at the factory and for many applications where the rope must be partially installed before the fitting is placed on the end or where, during its life reattachments must be made, it is not very well suited. It makes a very neat type of attachment and does not require much space, and one of the widest fields of use is for control cords and other assemblies used on airplanes.

Thimble splice—Other methods for attaching wire rope develop less than one hundred per cent efficiency. That means that in an ultimate strength test, the rope will break at the attachment at a value somewhat below the strength of the rope itself. A thimble splice, where the rope is looped around the thimble and spliced back into the body of the rope, has an efficiency varying from 75 to 95 per cent, depending upon the size of the rope involved. This type of attachment is not used as much today as it was some years ago, because increased labor costs have made it relatively expensive, and other types of attachment have been designed and are more suitable for those applications where thimble splices were formerly used. Incidentally, the loss of efficiency at the attachment is not as bad as it sounds, since in most cases the rope in the vicinity of the attachment is not subject to wear and operation over sheaves, and therefore does not deteriorate to the same extent as other parts of the rope. As a matter of fact the thimble splice or some of the other types of connection described below may be more suitable than a socket attachment, particularly if vibration or torsional stresses are involved, since they have the ability to dampen these stresses and prevent them from being concentrated in one short section of the rope. Where such stresses are involved, it is generally necessary to renew the attachment at certain intervals, and this practice should be followed regardless of the type of connection used.

Thimble and clips—This method of attaching a rope in the field is very common, because it is inexpensive and easily performed. When properly made an efficiency of about 80 per cent can be attained, but to do this it is necessary that the correct number of clips be used and that they be installed in the proper manner. The U-bolt part of the clip should always be in contact with the dead side of the rope, and care should be exercised to make certain that the nuts are installed to the correct degree of tightness. Naturally if the clips are loose, slippage will occur, but on the other hand if they are tightened to too great an extent, a shearing action might occur which would result in rapid development of broken wires on the rope.

Wedge socket—The wedge socket type of attachment is used on many excavating machines because of the ease and speed with which it can be made. A "no-pinch" wedge socket which is machined to close tolerance so as to cause as little rope distortion as possible on the live side of the socket, will develop an efficiency of about 90 per cent. Rough cast wedge sockets develop a lower efficiency, generally around 75 or 80 per cent.

MAINTENANCE

Proper maintenance of wire rope in service should include the periodic equalization of ropes of a set where two or more ropes are being operated in parallel. Multiple ropes are used on elevators, on some cranes, and generally on blast furnace hoists, and care should be taken during service to see that each rope comprising the set is sustaining its proper share of the load. This may necessitate adjustment of one or more of the ropes from time to time, and it is important not only to obtain maximum service from the ropes in question, but from the point of view of equipment itself. If one rope in a set is operating under greater tension than the other ropes, this rope will undoubtedly deteriorate rapidly, and at the same time it will wear its sheave grooves deeper than the grooves in which the other ropes are operating, thus resulting in a condition which will cause trouble for future ropes.

On some installations using wire rope, it is possible and necessary to make reattachments at the end or to cut and shift the rope during service so that maximum life will be obtained. On installations where vibration is encountered or impact stresses are involved or where for some other reason, severe fatiguing stresses are encountered at the connection, it is necessary to cut the rope and reattach it at frequent intervals to avoid failure at this point. This is particularly true on some hoists where the rope is attached at the load end and it is also generally true of dragline ropes. The same action may be encountered on cranes or other types of installations, and experience or careful examination of the rope at the attachment end will generally indicate the advisability of following this procedure.

Sometimes maximum deterioration will occur near one end of a rope, and when it is possible to install a longer length originally than is actually necessary to do a job, several cuts can be made during the life to eliminate this worn-out section. The closing line on a clamshell crane generally wears out quickest in a section which is reeved through the bucket sheaves, and where sufficient rope can be installed on the crane originally to allow one or more cuts here, considerably extra service may be obtained in this manner. Naturally the rope should not be so long that it will overwind on the drum or damage will be caused at this point and the original purpose will be defeated.

On dragline excavators, the rope quite often is subject to maximum wear near the bucket attachment, and most operators make a practice of cutting and shifting the rope with respect to this point.

On some installations where maximum wear is not so close to the end that this section can be eliminated, but where it is toward one end of the rope, extra life can be obtained by completely removing the rope from the installation and reversing ends so that by the time the rope is finally discarded, the wear will be more uniform throughout its entire length.

On installations where the rope must wind in several layers on a drum, periodic spots of abuse are generally encountered at the change of layers, and at the points on each wrap on the second layer known as the cross-over points. It may not be necessary or even feasible to change such a rope end for end, but very often this type of drum abuse can be distributed by cutting a short section from the drum end of the rope and shifting the rope so that the periodic spots of abuse will be brought to other points. On large mine hoist installations, cuts

of this nature are usually made three or four times during the life of the rope so as to distribute drum wear to the fullest possible extent.

One of the most important procedures of any maintenance practice should be the proper lubrication and protection of the rope while in operation. When the rope is fabricated, the manufacturer lubricates it both internally and externally to the best of his ability. Unfortunately, lubricants are not available today which are able to withstand the extreme pressures to which a rope is subjected and stay within the rope during its entire life. Neither are protectors available which will stick on the rope and protect it against corrosion for its entire life where the washing action of water, or other agents that tend to attack it, is severe. To keep the rope well oiled so that it will encounter a minimum of friction when operating over sheaves and drums and to protect it against corrosive agents, it is necessary in most cases to relubricate the rope while in service.

Again as in the case of the original lubricant, the type of material used should be suitable for the application in mind, and we can only stress the importance of applying this lubricant at sufficiently frequent intervals to thoroughly protect the rope at all times. With crane ropes or elevator ropes, a thin lubricant that can penetrate between the wires and into the core should be used, and with ropes that operate outdoors, this material should perhaps be a little heavier in viscosity so that it will not wash off and be lost quite so soon. In extreme cases where protection is the main requirement, heavy-bodied lubricants which must be applied in the heated state, are generally employed.

The extra life obtained from the rope that is properly protected and lubricated during service generally pays for the cost and labor of applying the lubricant and, what is more important, maintains the rope in such condition that its condition can be safely judged at any time.

Wire rope, unlike a good many other structural materials, provides for fairly accurate inspections as deterioration takes place. There may be cases where severe corrosion is involved, localized damage or some other form of unusual abuse which makes it difficult to estimate the true condition of a rope, but in general, a visual inspection allows an experienced observer the opportunity of estimating to a fair degree of accuracy its remaining strength.

As soon as a rope begins operating, metal is worn from the crowns of the outside wires. As long as the rope operates over sheaves or scrubs against stationary objects this wear progresses, but in time fatigue due to constant bending or due to some other factors, will be noticed. This makes itself apparent in the form of broken wires which develop on the crowns of the outside wires where they have already become worn. The inside wires in the strands remain intact, when corrosion is not a factor, and can be depended upon to sustain their share of the load. The strength represented by these wires is often referred to as "reserve strength" for this very reason.

It is seldom necessary when wire breaks first develop to remove the rope from service. A rope consisting of six strands and 19 wires each, has a total of 114 wires, and the breaking of a few of these will not represent very much loss in strength. Therefore it is usually possible for an inspector to watch the development of wear and broken wires from one inspection to the next, or in other words watch the rate of deterioration of the rope, and finally remove it after all of its safe and useful life has been obtained.

DISCUSSION

PRESENTED BY

JOHN LUSKY, JR., General Foreman, Maintenance, Open Hearth Dept., Lukens Steel Co., Coatesville, Pa.

M. F. REESE, JR., Foreman, Erectors, Mechanical Maintenance, Bethlehem Steel Co., Sparrows Point, Md.

LOUIS C. LEPROHON, Wire Rope Engineer, Bethlehem Steel Co., Williamsport, Pa.

J. A. BELL, Chief Engineer, Bethlehem Steel Co., Bethlehem, Pa.

C. R. HAND, Assistant Superintendent Mechanical Dept., Bethlehem Steel Co., Sparrows Point, Md.

FRANCIS C. WEISS, Engineer, Electrical Dept., Bethlehem Steel Co., Steelton, Pa.

W. I. LEX, Assistant Chief Engineer, Wire Rope Engineering Div., John A. Roebling's Sons Co., Trenton, N. J.

John Lusky, Jr.: One question bothers me. We had occasion recently to buy preformed rope and were guaranteed it would give longer life. Aside from the fact it was preformed, what other factor in the making of that rope will give us more life?

M. F. Reese, Jr.: I have two questions I would like to ask: In the Flemish eye what is the efficiency of it as an end fastener? Second, what type of eye-splice do you recommend? There are about a dozen different ways of making the splice around a thimble. I am talking of either preformed or common rope.

L. C. Leprohon: Tell us something about the use of zinc-coated wire ropes, as now being used more by the industry. Where can you obtain some of the helpful manuals or instructions on the inspection and removal of wire ropes from service? There are some good pieces of information to be obtained on this, and it is an inquiry which frequently comes up.

J. A. Bell: The author discussed the three elements entering into the manufacture of wire rope, the wire, the fiber core, and the lubricant. I think it would be a mightly good thing if Mr. Lex would sit down and design a wire rope with a hollow core center, fill it up with lubricant—and as soon as the crane is overloaded the strands would open up and squirt oil all over the floor. This might put a stop to the practice of overloading. We have the problem every day.

When we order a crane we specify, to the vendor, the size and the number of ropes to be installed on that

particular crane. That is, based, of course, on what we claim to be a reasonable factor of safety in our operation, which is 50 to 100 per cent greater than the crane manufacturers usually recommend. I was wondering if we left the selection of rope up to the manufacturer, how would the factor of safety in the furnishing of wire rope for hot metal ladle cranes compare to the conventional crane in the machine shop. I would be curious to know just what this figure would be.

C. R. Hand: Cable is much abused. We are continually attempting through teaching to have our employees treat wire rope with the respect that it should get. This consists primarily in having it installed properly, lubricated frequently, overloaded never, and to take it off as soon as inspection shows that it should come off. We are not always able to achieve such excellent results.

Years ago, lubrication of wire rope was something that the wire rope manufacturers deemed not necessary. There has since been much work done on the lubrication of centers of wire rope.

Today we get wire ropes or cables that are lubricated in the factory with the lubricants that are designed to stay for as long as I think it is possible to keep a lubricant under those circumstances. If the user puts a little bit of lubricant on the outside occasionally and keeps moisture out, he can expect long life.

I would like to ask the speaker how to get lubricant in between the strands of a wire cable under load. We have many of them under load.

Francis C. Weiss: I think I would differ from the author, however, in his statement that he recommends the use of the wire center in open hearth ladle crane wire rope. We have found the hemp center and fiber core wire ropes to be entirely satisfactory in this type of installation where apparently excessive heat is present. I also know several maintenance men in other steel plants who are of the same opinion. I would appreciate hearing Mr. Lex tell us of circumstances under which he found it necessary to use the wire center.

W. I. Lex: First, the question was asked about preformed rope. It was said that it was guaranteed to give longer life and the questioner wanted to know why. There are several characteristics which make preformed rope better than non-preformed, but the most important is that it has greater flexibility and will therefore stand fatigue better. Thus, if bending is the main consideration, a preformed rope in the same construction should operate to better advantage. If abrasion generally wears the rope out first, it is possible to use a coarser construction which will stand the abrasion better, and the preforming of the rope will make up for its flexibility.

A Flemish eye with pressed sleeve which is the type of loop we call the tapered sleeve splice, should develop the catalog strength of the rope. A Flemish eye is made in a preformed rope by separating three strands from the other three strands, and the core of the rope for a given distance from the end. These two sections are joined and laid back together again to form a loop and the sleeve is then pressed over the ends where they meet with the main body of the rope. With the proper type of sleeve and a loop sufficiently long to give proper snubbing action, the attachment should develop full catalog strength.

In the thimble splice attachment we recommend, the first strand is tucked under two strands on the live side of the rope, but after this each strand is tucked around just one strand. Four of the strands have two full tucks; whereas, the remaining two strands have three full tucks each. Each strand is then split, and about half the wires are given three more tucks. There are, of course, many different ways of making a splice, but we believe that to obtain good efficiency, ours is one of the easiest to make.

It was stated that no mention was made of zinc coated ropes and this was because such ropes are used for many special applications I did not intend to cover in the paper.

Zinc coated ropes can be obtained either as galvanized rope where the wires are galvanized in the finished size, or as a drawn galvanized rope where the wires have been galvanized and then drawn to finished size. Galvanized rope is lower in strength than bright rope, but the drawn galvanized is about similar to bright rope strength.

Zinc coated ropes of either type are used where it is expected to encounter severe corrosion, for most operation in and around salt water, and I might mention that today they are being used on some mine applications where the operating conditions are extremely wet. I do not know that these ropes will give any better service so far as resistance to abrasion and fatigue is concerned, but if they do nothing more than retard corrosion for a few weeks or months so as to extend the life of the rope by the same amount, they will serve a useful purpose.

It was also asked what literature might be obtained on wire rope removal. Probably most all of the wire rope manufacturers have literature available and would be glad to supply it on request. We have a wire engineering booklet that goes into this in some detail. Starting over twenty years ago, we did a lot of work on worn ropes, measuring the wear surfaces on the crowns of the outside wires and counting the broken wires per rope lay and attempting to correlate this information with the remaining strength of the rope. We developed charts enabling the man in the field to estimate remaining strength by making an examination and obtaining some of these measurements, and these charts were devised for several of the most common constructions used. Of course, the accuracy of such a method presupposes the fact that there is no corrosion or that the rope has not been kinked or damaged in a localized spot. We will be glad to furnish you that information if you will write to us.

I think that the idea of designing a rope with a hollow core is a good one. In fact at one time I thought that I might get a patent on a rope with a hollow space in the core and a lubrication fitting on the end so that it could be lubricated from this point. Rather than squirt lubricant onto the floor as a warning, we might have the rope designed to ring a bell after it had reached the extent of its full safe life. We have not been able to design that yet.

In regard to hot ladle crane ropes, it would be my

opinion that these should be designed with a higher factor of safety than for general hoisting purposes. Several years ago we established a practice in our own plant for our overhead cranes, and it was felt that for general hoisting rope the factor of safety should be at least 5 and for hot ladle cranes it should be 8. Obviously for one reason or another it is not always possible to maintain the desired degree of safety, but when this cannot be done, it should be the rule that the ropes should be condemned on a more conservative basis. For instance, it might be permissible to allow a rope for a certain application to deteriorate to 80 or 85 per cent of its original strength. If, however, the factor of safety must be lower, then it should be necessary to condemn the rope sooner, let us say when it has reached 90 or 95 per cent of its original strength—that is, with 5 or 0 per cent deterioration.

It was stated that some years ago wire rope manufacturers did not pay much attention to the lubrication of rope. Of course, I was not here too many years ago, but ever since I have been with my company, we have paid very good attention to the lubrication. Naturally there is a lot which has been done to improve it, and I will certainly agree that it is better today than some years ago. However, the lubricants we put in the rope, no matter how good, will not stay in the rope throughout its entire life because the washing action of water, the picking up of dirt and grit, and also the pressure of operating over sheaves, all tend to bring it to the surface where it becomes lost.

You should, of course, lubricate wire rope in the field to get the greatest life from it. You can get better service and safer operation when you apply lubricant.

Because we questioned the ability of lubricants applied to a rope in service to penetrate inside and do real benefit to the cores, we made a series of tests a year or so ago. We duplicated as nearly as possible the operating conditions in the field, since we ran a rope under heavy load over a sheave which was sufficiently small to produce fairly high pressures. We made up a special rope that was dry, even in the core, except for the 1 to 2 per cent of cordage oil which was necessary to spin the fiber.

We used several different types of lubricant. Some were thin and were dripped onto the rope. Others were heavier and had to be heated before application. In all cases we ended up with a rope which had more lubricant in the core than when we started, and in the best cases it was found that lubricant equalling 8 or 9 per cent of the weight of the core had been absorbed by this member.

A fiber core when it is made is of course lubricated, and this lubricant amounts to about 15 per cent of the total weight of the core. All of this lubricant cannot stay there when the rope is subject to the pressures encountered during operation, but when you are able to take a dry core and get as much as 8 or 9 per cent into the rope by lubricating it during service, I think it will prove that you can obtain some benefit by applying lubricant in the field.

Incidentally the trend today is toward the use of thinner lubricants that will be better able to penetrate the rope. These can be sprayed or dripped onto the rope and where they are applied often enough they are doing an excellent job.

It has been stated that on some hot ladle cranes the use of wire rope with fiber core has performed satisfactorily; whereas, I recommended a rope with independent wire rope core for this service. I also know of some cases where fiber core ropes are used for this service. However, as a general recommendation, a rope with independent wire rope core must be specified because there are many cases where the heat encountered by the rope is sufficient to quickly dry out the core or actually burn it and cause the center to collapse. If the traveling block is far enough away from the ladle so that sufficient heat does not reach the rope to cause any deterioration of the core, then I can understand why a rope with fiber core can be used satisfactorily. This, however, is not always the case.

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SELECTING DRIVE MOTORS

For Flying Shears

By WARREN REID
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. . . . proper performance of flying shears is dependent on considering all the engineering factors, and also on good motor and control performance . . . .

▲ THE application of a flying shear belongs to that list of applications in which the horsepower requirement is not ordinarily the primary interest. With the high mill speeds of today, the principal concern is the accelerating torque available at the shear shaft. If the accelerating torque is available, the duty cycle usually encountered is such that the problem of heating (and thus rms horsepower) becomes of secondary importance.

The mechanical construction of shears varies somewhat among the different mill builders. For purposes of illustration, assume that the shear is one in which the top and bottom knives are of the same diameter and so geared that one complete revolution of the shear output shaft will result in the shear making one cut. A flying crop shear, so constructed, is shown in Figure 1. If the shear is to cut the front and back end of a rod, it must accelerate from rest up to the required speed, make the cut, then decelerate and stop—all within a limited degree of rotation—to avoid making a "mis-cut." The actual number of degrees the shear shaft may rotate for any one cycle of operation depends upon whether a "non-reversing" or "reversing" type control is used.

The operation of a "non-reversing" or "reversing" type control is shown in Figure 2. The shear is at rest at "a" when it receives its cue to start the cycle; at "b" it is up to speed; between "b" and "c" the cut is made; at "c" the shear starts decelerating; at "d" is down to a creeping speed; and when approaching "a" it is mechanically braked to assure an accurate stop at "a."

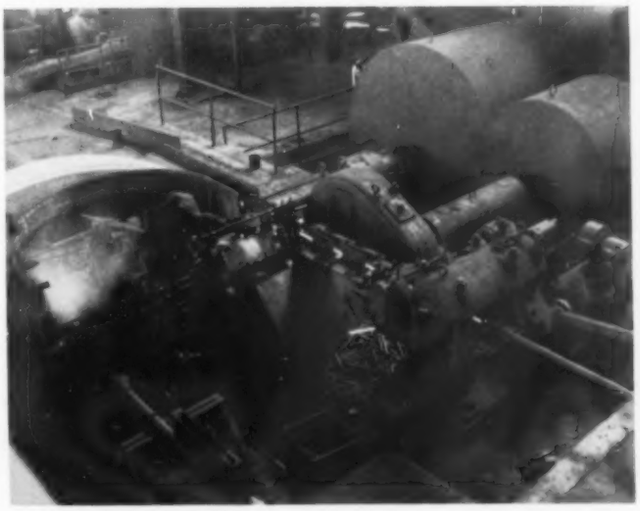
Figure 3 illustrates a reversing type control. Here the shear is at rest at "a" when it receives its cue to start the cycle. It accelerates (clockwise) and is up to speed at "b"; between "b" and "a" the cut is made; at "a" deceleration commences (rotation continuing clockwise), and the shear stops and reverses when reaching "b." The shear then accelerates (rotating counter clockwise) until reaching "c," at which time deceleration commences and it is down to a creeping speed at "d." When approaching "a" (rotating counter clockwise) the shear is mechanically braked to assure an accurate stop at "a."

The non-reversing control is simpler, but the driving motor must necessarily exert a greater torque than would be required if the control provided for a reversing operation. The type control selected depends upon the requirement of the shear. In general, the non-reversing control would be used if the time interval between cuts is relatively short and the maximum mill speed is not too high.

Before attempting to select the appropriate shear driving motor or the control for this motor, the following information should be known:

1. The WR^2 of the shear at the shear shaft.
2. The diameter of the shear head.
3. The maximum and minimum speed of the material to be sheared.

Figure 1 — Top and bottom knives of flying crop shear shown have same diameter.



4. The interval between cuts.
5. The estimated shearing load in pounds.
6. The arc, in degrees, required for the cut.

In addition, it is necessary to know the gear ratio, if such has been selected; however, in order to select the gear ratio, it is well to first select a motor and then determine what ratio would be most suitable for the application. The actual gear ratio can have considerable effect on the time required for accelerating the shear from rest up to a speed equivalent to the mill speed. The optimum ratio, of course, would result in a minimum accelerating time. In order to solve for the actual value of the optimum ratio, it is necessary that the inertia of the shear and the inertia of the motor, brake and coupling be known.

The general case can be illustrated by the following:

Let:

J_M = the inertia of the motor, brake, and coupling in lb ft^2

J_E = the inertia of the shear in lb ft^2

rpm = the revolutions per minute of the shear shaft at the time of the cut

T_M = the average required torque in lb ft at the motor shaft

t_a = the accelerating time in seconds

GR = the gear ratio

When the familiar equation $T_M = \frac{WR^2 \times rpm}{308\ t_a}$ is rearranged and the WR^2 separated into its J_E and J_M components, the equation can be expressed as follows:

$$t_a = \frac{\left(J_E + J_M\ (GR)^2\right) rpm}{308\ T_M\ (GR)} \qquad (1)$$

For any one motor, T_M is constant as long as the motor speed does not exceed base speed. Since the rpm of the shear is fixed for any one shear diameter and desired mill operating speed, the expression $\frac{rpm}{308\ T_M}$ can be represented by a constant. Therefore,

$$t_a = K\left[\frac{J_E}{(GR)} + J_M(GR)\right] \qquad (2)$$

By differentiating t_a with respect to GR, equating the result to zero, and solving for a point of inflection, it is found that,

$$GR = \sqrt{\frac{J_E}{J_M}} \qquad (3)$$

By substituting in (2) above, values of GR which are slightly greater or less than $\sqrt{\frac{J_E}{J_M}}$, it is found that the point of inflection represents a minimum value. Therefore, when the WR^2 of the motor, brake, and coupling, and the WR^2 of the shear (when referred to the same shaft) are exactly equal, the time to accelerate becomes a minimum value.

The general case given above is not strictly correct since the effect of friction has been omitted. The omission, however, can be defended since the overall time cycle for one operation of the shear involves both acceleration and deceleration. During acceleration, frictional forces must be overcome, thereby tending to increase the accelerating time. During deceleration, just the opposite is true. Therefore, the frictional forces tend to cancel out as far as the time for one complete cycle of operation is concerned.

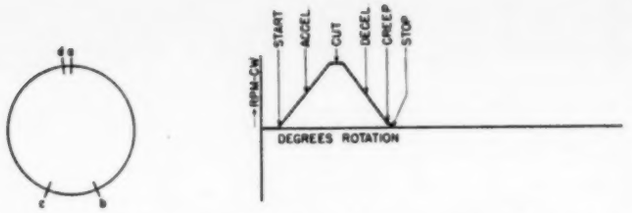


Figure 2 — Schematic sketch of non-reversing flying shear control.

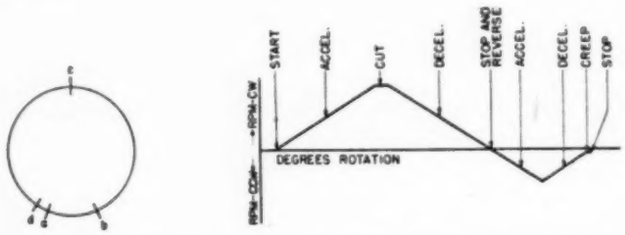


Figure 3 — Schematic sketch of reversing flying shear control.

The importance of selecting the correct gear ratio best can be illustrated by an example. Assume that the following data are available for a typical shear:

Shear $WR^2 = 600$ lb ft^2

Shear diam = 24 in.

Mill speed = 1000 fpm

Shear cutting arc = 45 degrees

From calculations made later in this article, a 25-hp, 650-rpm mill motor has been selected for driving the shear. The WR^2 of the motor, brake, and coupling is approximately 44 lb ft^2. An average value of 175 per cent full load torque, or 354 lb ft, is available for accelerating. It has been assumed that the peripheral speed of the shear knife should be 10 per cent higher than the mill speed, resulting in a shear rpm of 175. Substituting in equation (1) of the general case, results in the following:

$$t_a = \frac{600 + 44\ (GR)^2 \times 175}{308 \times 354 \times GR}$$

By letting GR vary between 1.5:1 and 7.5:1, the various accelerating times have been computed, and the results are shown in Figure 4. When the gear ratio equals the square root of $\frac{600}{44}$ or 3.695, the time to accelerate is a minimum or 0.52 seconds.

The computed optimum gear ratio cannot be used in every application. It should be noted in the general case given above that the optimum gear ratio, as far as minimum accelerating time is concerned, is dependent solely upon the inertia of the shear and the combined inertia of the motor, brake, and coupling. The mill speed or motor speed does not enter into the calculations for the optimum ratio. With reference to equation (1) of the general case, it is obvious that the accelerating time is a minimum when the motor torque is at a maxi-

TABLE I

Motor and Brake Constants

Direct-Current Mill Motors					Direct-Current Magnetic Brakes	
AISE Frame No.	1-Hr hp rating	Base speed in rpm	Torque in lb ft	Armature WR^2 in lb ft^2	Wheel diam, in.	Wheel WR^2 in lb ft^2
2	5	1025	25.5	1.4	6	0.3
602	7.5	900	44	3.2	8	1.1
603	10	800	65.5	4.5	10	5.0
604	15	725	109	8.75	10	5.0
606	25	650	202	26.7	13	12.3
608	35	575	320	46.0	13	12.3
610	50	550	477	81.0	16	34.0
612	75	515	765	133.0	16	38.0
614	100	485	1080	195.0	19	88.0
616	150	460	1710	375.0	23	200.0
618	200	420	2500	820.0	23	200.0

This tabulation applies to shunt-wound, 230-volt mill motors rated 75 C rise, 1 hour, if totally enclosed, or 75 C rise continuous, if force-ventilated. The speeds and torques given are full-load ratings. The brakes are considered adequate for flying shear applications discussed in this article.

mum. The characteristics of any direct current motor are such that the full load torque is available between zero rpm and the rpm at the base speed or full field setting. By using the computed optimum gear ratio and knowing the shear head diameter and mill speed, the required motor rpm can be calculated. If this rpm is equal to or less than the motor base speed, then the computed optimum gear ratio should be used. If the required motor rpm is greater than the motor base speed, then there are several alternatives.

First, the gear ratio may be varied from the optimum ratio in such a manner as to bring the required motor rpm down to base speed. This method results in a longer accelerating time and the particular application must be checked to see if this increased time can be tolerated. In many instances, the gear ratio chosen can vary considerably from the theoretical optimum ratio without materially affecting the minimum accelerating time. In Figure 4, it should be noted that the actual gear ratio might vary between 82 and 122 per cent of the optimum ratio without increasing the minimum accelerating time over approximately 2 per cent.

Second, if the motor is supplied by an adjustable-voltage generator, the voltage may be increased, thus increasing the motor speed up to a value at which the optimum gear ratio is suitable. The 230-volt, mill-type motors described in Table I could be supplied from a 460-volt source with the rpm increasing in proportion to the voltage.

Third, the motor field strength could be weakened such that the speed is increased to the value required when the theoretical optimum gear ratio is used. This method sacrifices the average available accelerating torque and thus increases the minimum accelerating time. It is not ordinarily used except for applications in which the shear driving motor is supplied from a constant-voltage source.

With a mill speed of 1000 fpm and a shear diameter of 24 in., to make the peripheral speed of the shear knife exactly equal to the speed of the material being sheared, the shear rpm must equal $\frac{1000}{\frac{\pi 24}{12}}$ or 159 rpm.

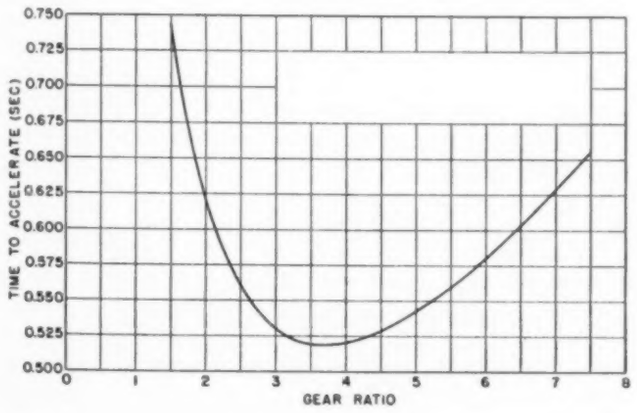
Assuming that the best operating conditions occur with the shear knife running approximately 10 per cent faster than the material being sheared, the required shear rpm would be 110 per cent of 159, or approximately 175 rpm.

From the original given conditions, it is noted that the cutting arc required is 45 degrees or one-eighth of one revolution of the shear. Let us first investigate a shear using a reversing type control as was given in Figure 3. Here it is seen that the shear must start accelerating from rest at point "a" and be rotating at 175 rpm when point "b" is reached. Since seven-eighths of one revolution is available for this acceleration at an approximate average speed of $\frac{175 \text{ rpm}}{2 \times 60}$ or 1.46 revolutions per second, then the time required for acceleration is $\frac{7/8}{1.46}$ or 0.6 seconds.

Rearranging equation (1) of the general case and substituting the values of the shear WR^2 and the required accelerating time computed above, results in the following:

$$T_M = \frac{600 + J_M (GR)^2 \times 175}{308 \times (GR) \times 0.6}$$

Figure 4 — Sketch shows relationship between acceleration time and gear ratio when $J_M = 44$ lb ft^2 and $J_E = 600$ lb ft^2.



The solution now becomes one of "trial and error"—that is, by referring to Table I, we select a motor, brake, and coupling, compute the optimum gear ratio, substitute the values of J_M and GR in the above equation and solve for T_M. Different motors should be selected and the computed T_M expressed as a percentage of the full-load motor torque (T_{FL}). The calculations should be continued until this percentage is in the neighborhood of 150 or 175 per cent depending on whether the motor is supplied from a constant or an adjustable voltage source. A check then should be made, using the optimum computed gear ratio, to determine if the required motor speed is equal to or less than the particular motor base speed.

Computations have been made for the example given above, using 15-, 35-, and 25-hp mill-type motors and the results are tabulated in Table II.

TABLE II

Motor hp	T_M	Optimum gear ratio	Required motor rpm	$\frac{T_M}{T_{full\ load}}$ per cent
15	195	5.82	1017	252*
25	308	3.695	647	152
35	369	3.08	538	115

*The full load torque used here is that torque corresponding to rated horsepower and required motor rpm.

This tabulation indicates that the 15-hp motor would not be used when supplied with its rated voltage. It should be noted that the rated rpm of the motor is 725 and the required rpm of 1017 is obtained by field weakening, the latter being made at a sacrifice of torque, and accounting for the high percentage of $\frac{T_M}{T_{full\ load}}$.

The 15-hp motor might be used if it were supplied from an adjustable voltage generator. In this case the required 1017 rpm could be obtained with full field and with 325 volts on the armature. The ratio of $\frac{T_M}{T_{full\ load}}$ would be reduced to 179 per cent.

The 35-hp motor would certainly do the job, but is somewhat larger than necessary.

The 25-hp motor probably would be chosen, since the average torque of 152 per cent of full load torque is well within the rating as far as commutation is concerned, and there is an allowance for some variation in gear ratio without requiring an excessive accelerating torque.

Let us now investigate the selection of a motor for the same application and assume that the non-reversing type control will be employed. The motor torque required is necessarily greater than if the control provided for reversing, since only one-half as many revolutions can be made during the accelerating period and the required cutting speed has remained unchanged. The method of calculation is very similar to that described previously for the reversing type control and only the results are indicated in Table III.

TABLE III

Motor hp	T_M	Optimum gear ratio	Required motor rpm	$\frac{T_M}{T_{full\ load}}$ per cent
50	1031	2.2:1	388	216.0
75	1272	1.787:1	313	166.5
100	1632	1.39:1	243	151.0

The 75-hp motor would be selected if it were to be supplied from a variable potential source and the 100-hp motor would be selected if a constant potential supply were to be used.

The motors selected for either the reversing or non-reversing type control were chosen solely on the basis of having sufficient accelerating torque. However, if the shear is to make numerous cuts at high speed, then the duty cycle must be considered, and a calculation made of the rms horsepower. Another point sometimes warranting consideration, is the minimum cut required. The minimum cut is the product of the strip speed and the elapsed time between cuts. The elapsed time is the summation of the time for bringing the shear to rest after a cut and the time for bringing it up to speed again at the cutting position, including, of course, the time for operation of the various control relays.

The selection of motors and control for flying shear drives is an engineering problem which is often of considerable magnitude. Proper consideration of all factors involved coupled with good motor and control performance is a necessity for this type of application.

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ASSOCIATION OF IRON AND STEEL ENGINEERS, 1010 EMPIRE BLDG., PITTSBURGH 22, PA.

FUNCTIONS OF THE LUBRICATING ENGINEER

By C. R. HAND
Assistant Superintendent, Mechanical Dept.
Bethlehem Steel Co.
Sparrows Point, Md.

. . . . a well trained lubricating engineer assigned to a steel plant can minimize machine failures . . . . the resultant effect is more and cheaper production . . . .

▲ THE functions of the lubricating engineer involve some of the problems encountered by almost all engineers, with particular emphasis on the physical, metallurgical and chemical phenomena peculiar to the motion of one machinery part against another.

These problems include:

1. Design (materials and physical structure), manufacture, proper clearances and correct alignment of shafts, bearings and correct meshing of gearing.
2. Adequate sealing of moving parts.
3. Substantial foundations, and proper erection procedure.
4. Selection of proper lubricant for each piece of machinery.
5. Selection of equipment for applying lubricants.

The goals to be achieved are:

1. Minimum wear and breakage.
2. Reduced power loss due to friction.
3. Minimum lubricant consumption.

In order to get the most value from the trained engineer, he must be given every opportunity to use his skills. This also applies to the lubricating engineer. He must be kept advised of all proposed changes in design where relations of fixed to moving parts are concerned. Drawings and specifications for new equipment should be submitted to him for comments and recommendations. He will then have the opportunity to point out important points in well-designed equipment which will contribute to long life of parts and minimum loss of power and lubricants. He will likewise have the opportunity to criticize poor design and make an effort to have designs changed.

His studies will cover materials in gears, bearings and shafting, and the size of housings for the equipment. Gear-tooth design, meshing and alignment should be carefully checked. He is aware that extreme pressure compounds will not overcome wrong design. The lubricating engineer will make careful check to see that the bearings which support the gears are adequate. Bearing failure may be said to cause 90 per cent of gear breakage and rapid wear of teeth. This is not always easily and quickly determined. Mitre gears and bevel gears, particularly spiral gears and hypoid gears, may fail due to lack of strength in the supporting housings and bearings. During erection, long line shafts in mill drives need particular attention by all, including the lubricating engineer, to avoid rapid failure. Cases are on record where spiral bevel gears run out of mesh as much as 0.060 in. from cold to operating temperatures. It will be noted that this throws the load on the top section of gear teeth, a condition which always results in breakage.

Plain bearing materials have been studied by many interested engineers in the last ten years. Various types of alloys, pouring temperatures, bonding and machinability, have all been investigated and much valuable information is available. In spite of this, poorly designed bearings continue to come into the steel plants. The lubricating engineer can do much to prevent this, if given the opportunity.

Ball and roller bearings are of particular concern to the lubricating engineer. Many times undersize bearings are installed because sufficient space is not available, without any effort to provide adequate space for the proper size bearing.

Correct design of seals is also very important. The lubricating engineer will strive to have sufficient space to allow the right type of seal to be installed. Much information is available on this subject. However, it is too often ignored and a slipshod type of seal provided.

Foundations may present problems which should get proper attention from all, including the lubricating engineer. Misalignment, caused by one section of a mill or machine sinking, can cause much bearing, shaft, gear and housing trouble. In such cases the cause is sometimes very hard to detect. Roll bearings have run hot and continued to run hot regardless of the type of lubricant used, until the housings were properly aligned. The lubricating engineer should have an opportunity to see that equipment is leveled, aligned, properly grouted and bolted down. Much damage may be caused by improper procedure during grouting and setting up.

Piping to turbine and pump inlets and outlets must also be the concern of all, including the lubricating engineer.

The selection of lubricants for a particular type of

equipment becomes a simple problem when all design and alignment problems have been correctly handled. Since this is seldom the case, the lubricating engineer is obliged to keep abreast of all developments that produce improved lubricants. The old days of black oil and Albany grease, open gears and bearings are gone. Unfortunately, this is not true in the minds of some designers of steel mill equipment. We, therefore, have extreme pressure compounds for use with undersized and incorrectly designed equipment. Many new types of greases are available. All of these have particular application for heavy loads or high temperature conditions. The lubricating engineer can sometimes make use of these to help guarantee continued production of improperly designed equipment. He will, however, strive to prevent any new additions of equipment which may demand special lubricants. He will, at all times, keep the number of different oils and greases at the lowest number possible in order to hold down storage space to a minimum. In some steel plants, hundreds of barrels of lubricants must be kept on hand.

In selecting equipment for applying lubricants, the lubricating engineer has many factors to consider. Viscosity, possible contamination, cleaning cycle and working temperature are all of vital importance in the selection and application of oils. In the case of greases, similar problems arise. Temperatures, loads, speeds and location must be studied before a selection is made. The equipment selected for pumping or distributing grease is dependent on the type, whether extreme pressure, heavy, or light. The various systems, single line, dual line, or impulse type, all function satisfactorily. Consideration must also be given to the type of machine and space available for valves, pipe, tubing and hoses.

After all design, manufacture and erection are complete, the lubricating engineer must make sure that all gear cases, bearings and systems are clean. He will also see that proper "run-in-time" has elapsed on each piece of equipment before the machine is put into production. In addition to the above problems, the lubricating engineer also can and does make studies of packings, cup leathers, and the various applications of these materials, paying particular attention to wear caused by high friction. Chromium plating and metal spraying problems also claim his attention. These are becoming more and more important to good lubrication at high speeds. Continued studies of all factors, including production department problems, tend to make the lubricating engineer one of the best informed men in the plant.

In the foregoing paragraphs, effort has been made to cover the problems encountered by the lubricating engineer and the extent to which he is obliged to work to solve these problems. The number and scope of the problems are obviously determined by the size of the plant where he works. The large continually expanding plants make great demands on his skill. The results which have been obtained during the past ten to twenty years in plants employing full-time lubricating engineers show the value of these men. Hot bearings, broken gears and shafts are far less frequent today than formerly. Waste of lubricants is much reduced. Production records are frequently broken. This all points to good design and lubrication, credit for which, to a large extent, goes to the lubricating engineers.

Future lubrication development will enable the lubricating engineer to continue his contribution to the extreme production demands which we are now obliged to meet.

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Industrial Applications of Sonic Energy

By C. RICHARD SODERBERG, JR.
Chief Engineer
Ultrasonic Corp.
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. . . . sonic methods are proposed to clean open hearth gases . . . . they also show promise for other steel plant applications such as agitators for pickling . . . .

▲ THE purpose of this paper is to give a brief description of the industrial applications of sonics by describing the work of a company which has specialized in the manufacture and application of large scale mechanical sound generators. The name "Ultrasonic" has become somewhat of a misnomer as most of its installations are in the audible range. This paper, therefore, will be a discussion of the industrial applications of sonic equipment and the development required for this equipment to be used on an industrial scale.

Before a description of this work is undertaken a few definitions are in order. A quantity used extensively in acoustics is termed "intensity" and is a measure of the energy transferred through a medium by a sound wave. This phenomenon is accomplished by compressing and then expanding the gas and can be represented by visualizing a string of railroad box cars located so that their couplings are extended. If the first car is given an initial displacement it will move until it collides with the second car. Through this collision, the first car will stop and in the idealized case, the second car will receive the velocity which the first one possessed. The energy will be transferred in this manner through the entire chain. An energy transfer has been accomplished by the process because the energy of the first car has now been transferred down the line to the car in motion. The analogy can be extended by saying that the intensity of the waves is represented by the amount of energy contained per box car. The best means of changing this, and retaining the velocity, is to increase the weight of each car. In a gas, the energy is represented by the velocity and pressure amplitude which are related by gas laws. Intensity is therefore, a rate of energy transfer and has the units of watts per cm^2 or hp per ft^2. To cover the terrific range of intensities a logarithmic scale in terms of decibels has been devised.

Approximately 160 decibels is the intensity in a typical agglomeration vessel and, actually, compares to 10,000 times more energy than that transmitted from the noisiest thunderstorm or piece of artillery. The human ear can detect sound intensities as low as 10 decibels or a factor of 10 followed by 14 zeros less than the intensity in agglomeration vessels. A sinusoidal plane progressive wave of 160 decibels intensity will have a pressure amplitude of 0.283 psi. Agglomeration vessels, however, do not contain plane progressive waves but can be depicted by a chamber with waves traveling in all directions. An enclosure containing such

Figure 1 — Sketch shows operation of sonic collection system.

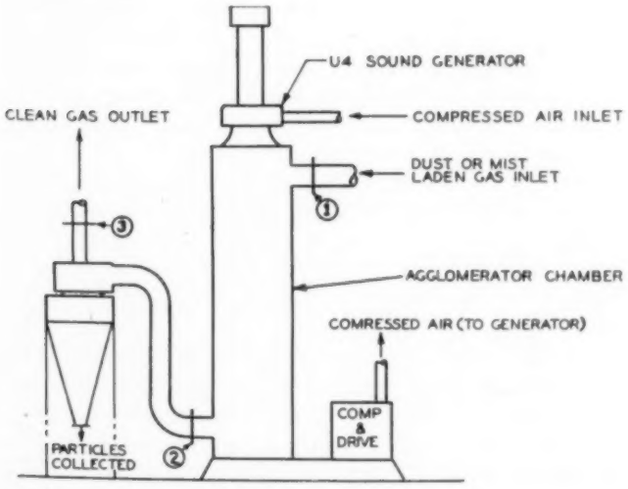
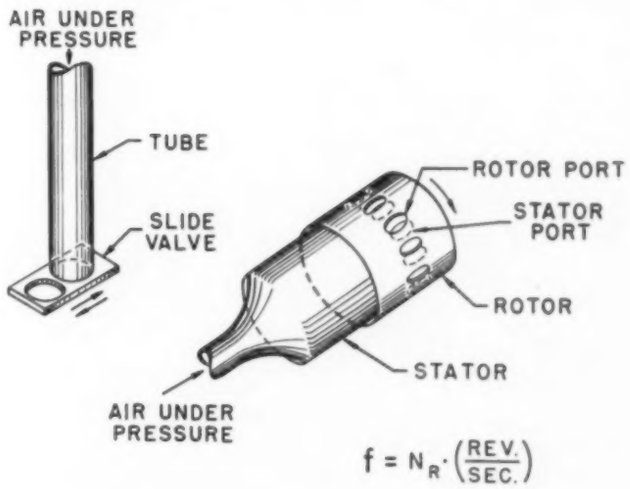


Figure 2 — Schematic drawing of series or valve type sound generator.



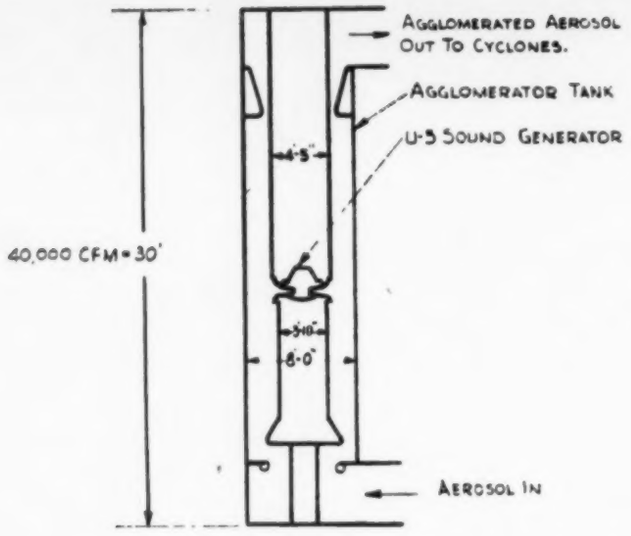


Figure 3 — Schematic diagram of radial generator installation.

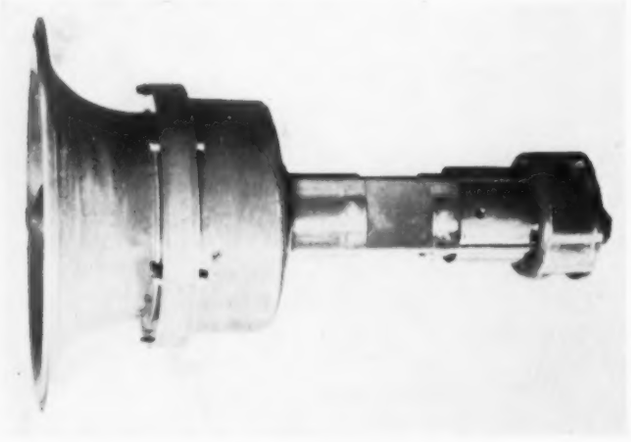
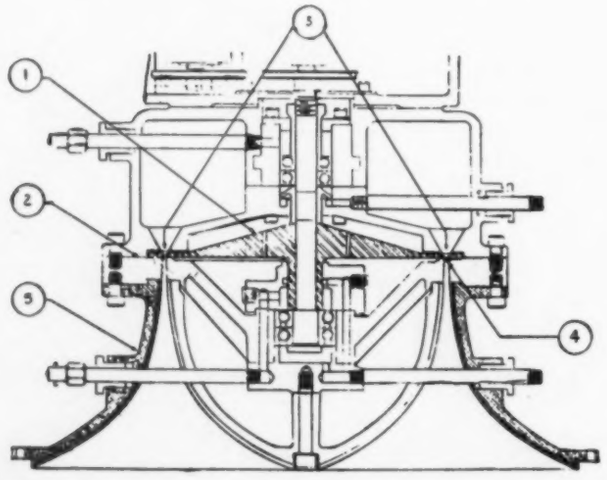


Figure 4 — Small axial sound generator.

Figure 5 — Cross sectional view of axial sound generator.



① ROTOR ③ ROTOR PORTS ⑤ ACOUSTIC HORN
② STATOR ④ STATOR PORTS

a random sonic structure is usually termed a reverberant chamber.

This high intensity in the audible range brings up the question of noise nuisance. Sound insulation, however, has become a well known science in the last few years and the latest installations make so little noise that it is easy to carry on a normal conversation beside properly insulated tanks.

A quantity commonly used in gas cleaning is named, "concentration" or sometimes, "grain loading." This is defined as the weight of entrained material, regardless of size, per cubic foot of gas. Common units for this are grains per ft^3 or milligrams per ft^3.

Another term often used is "aerosol." This is defined as a gas bearing entrained dust or mist.

GAS PHASE

The following will cover advances made in developing a mechanical gas phase generator as opposed to piezoelectric or magnetostrictive devices, the operation of a generator in conjunction with the agglomeration tank, the mechanism of agglomeration, and typical applications of this phenomenon in the gas cleaning industry.

The major portion of our work has been devoted to gas phase sirens as particularly adapted to the gas cleaning industry. Here sonic energy is used to agglomerate fumes and mists so that they can be more readily collected in a secondary collector. The chief components of this type of system, a sound generator, an agglomeration tower and a secondary collector are illustrated by Figure 1.

Sound generators and agglomeration vessels—Mechanical sound generators have been developed around two basic types, a radial model and an axial model. Figure 2 shows the difference between these configurations with the radial unit represented by the illustration on the right. The axial unit is illustrated by the other sketch but the slide valve is usually part of the rotor.

Radial generators, though acoustically quite good, are subject to severe maintenance and operational difficulties because of their location. They must be situated within the tank, as shown in Figure 3, because the sound is emanated radially and the gases must flow by the region of high intensity. The process gases are invariably hot (300 to 400 F) and usually corrosive, thereby curtailing bearing life whenever the gases come in contact with the lubricated surfaces. This phenomenon will occur primarily when the sound generator is turned off, as in starting or stopping, but it is still a serious limit on the bearing life of radial generators. If any maintenance must be done on the generator, their location is such that they cannot be reached without shutting down the entire plant.

The axial generator was evolved to overcome these difficulties and, as Figure 1 shows, it permits easy access without interfering with the process gas flow. A photograph of a small axial generator is shown in Figure 4 and a cross sectional view is illustrated by Figure 5.

A great deal of time was spent on the development of the axial generator which has brought the efficiency from 10 per cent on the first models to 50 per cent on its latest unit. This improvement was obtained by applying fundamentals of good acoustic and aerodynamic

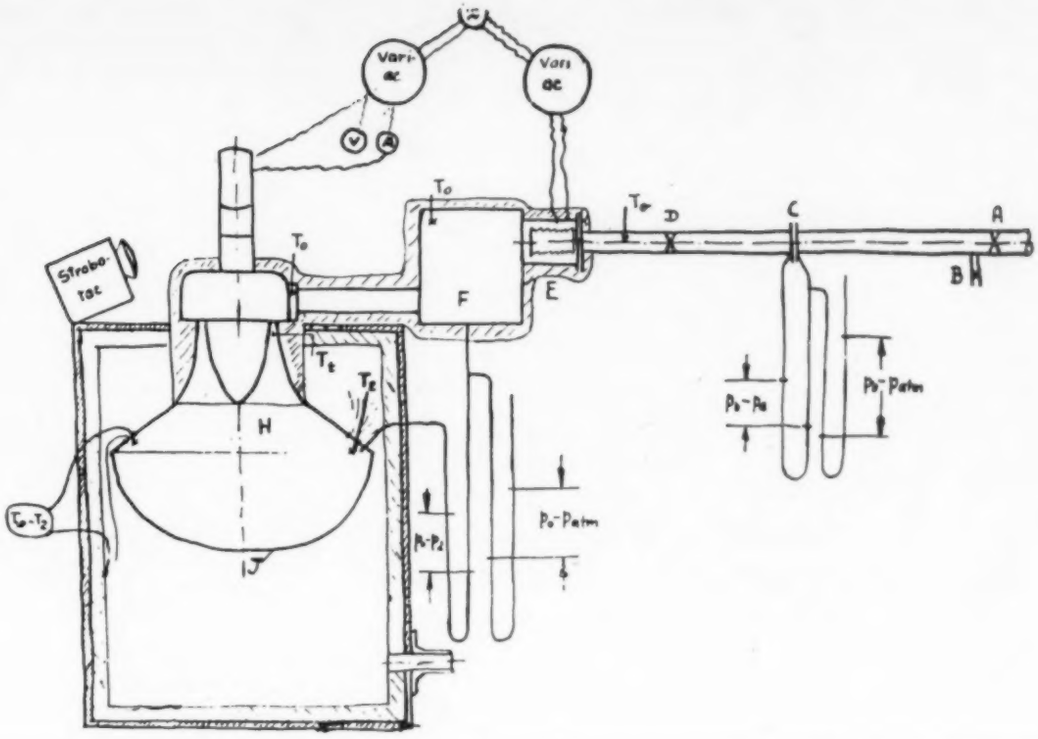


Figure 6 — Schematic diagram shows thermodynamic means of measuring acoustic output.

design to the horns and rotors thereby minimizing any diffuser or horn losses.

These efficiency figures raise the question of performance measurement and this has been one of the major problems. Initially, an attempt was made to use standard crystal microphones to measure the acoustic output, but it was impossible to obtain satisfactory calibration curves for these microphones. The main difficulty was that conventional calibrations were in the range of 120 decibels while measurements of intensities in the 160 decibel range were desired.

Rather than embark upon an extensive microphone development, a thermodynamic means was resorted to for measuring the sound generator output. The test arrangement is illustrated by Figure 6 where the generator is shown mounted on an acoustically insulated box which simulates free field radiation. A diaphragm (J) covers the horn, and by measuring the temperature drop (T_0—T_2) of the air through the siren, the energy available for heat transfer and acoustic radiation through the diaphragm, can be obtained. The heat transfer is eliminated by proper heat insulation, thereby giving the acoustic output.

In addition to obtaining a high output from the sound generator, the agglomeration vessel must also be designed so that it contains a sonic field of maximized intensity. The operation of an agglomeration tank can be understood by visualizing its functioning in terms of energy flow. The generator furnishes the energy input as shown by Figure 7, thereby compensating for any tank losses. These consist of port losses and wall losses, both of which are proportional to internal intensity level. As energy is poured into the tank by the sound generator, the intensity level builds up to a point where the losses balance the input, thus giving the tank operating intensity.

Agglomeration — The mechanism and theories of agglomeration are not fully understood, but a simple

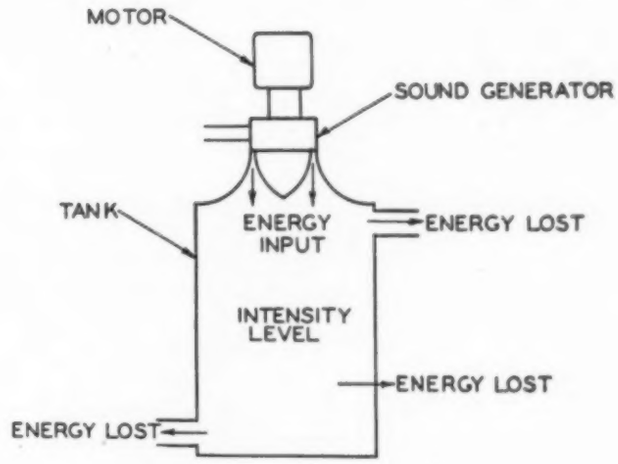
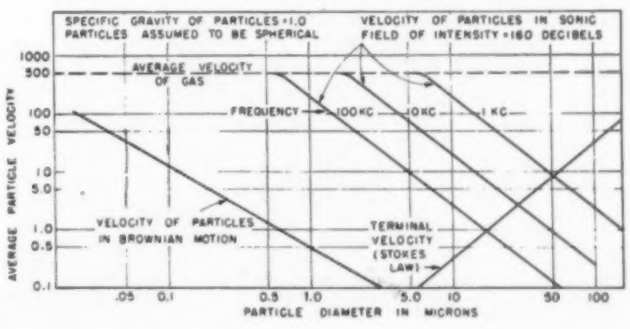


Figure 7 — Schematic diagram of tank operation.

Figure 8 — Particle velocities are given for various types of forces.



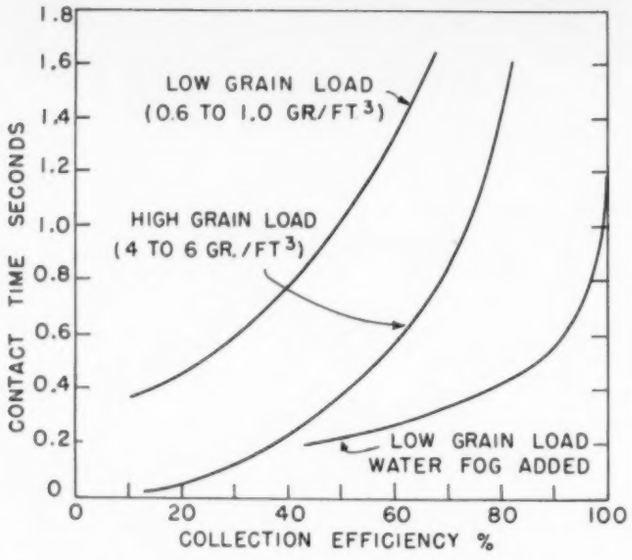
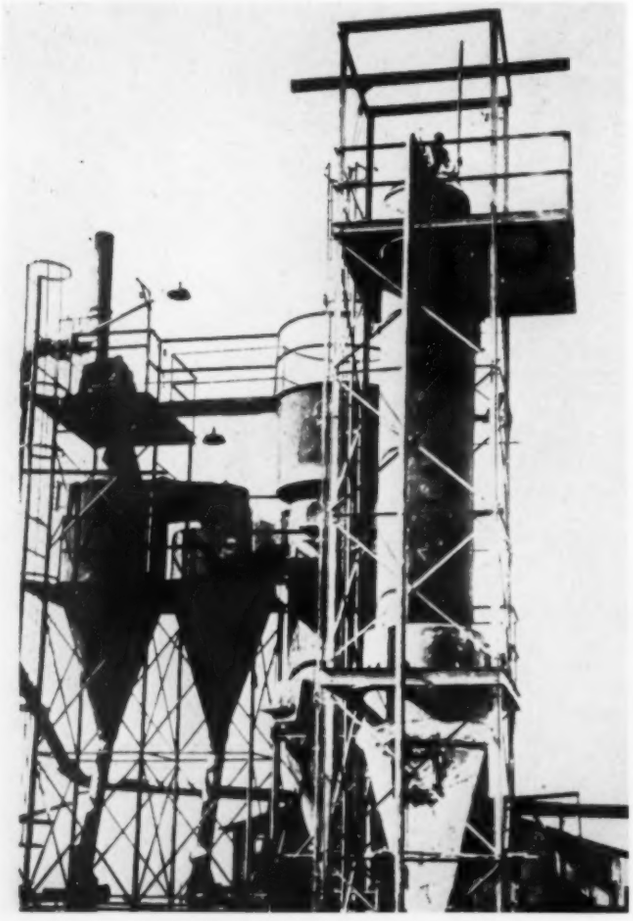


Figure 9 — Collection efficiency of 93.5-95.0 scale furnace black as a function of time and exposure.

picture can be obtained by visualizing the sound field as a series of oscillating pressure gradients which have been set up in the agglomeration chamber. With these pressure gradients exist alternating velocities of the gas which exert aerodynamic forces on the suspended

Figure 10 — Pilot plant for sonic carbon black collection system.



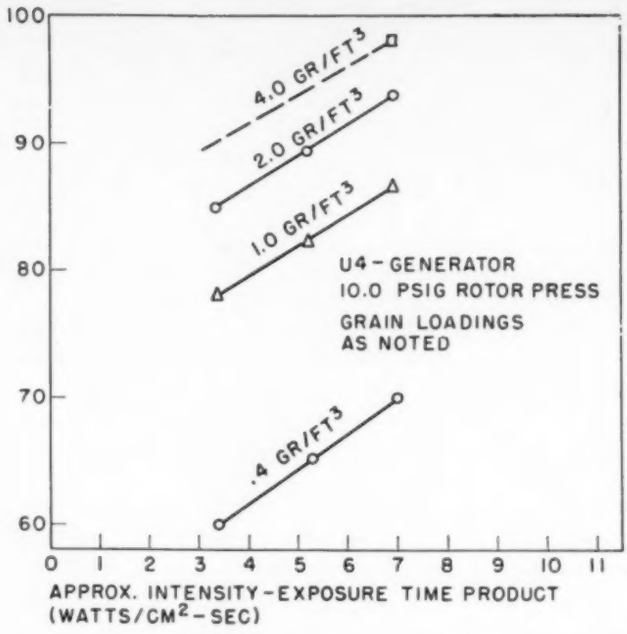
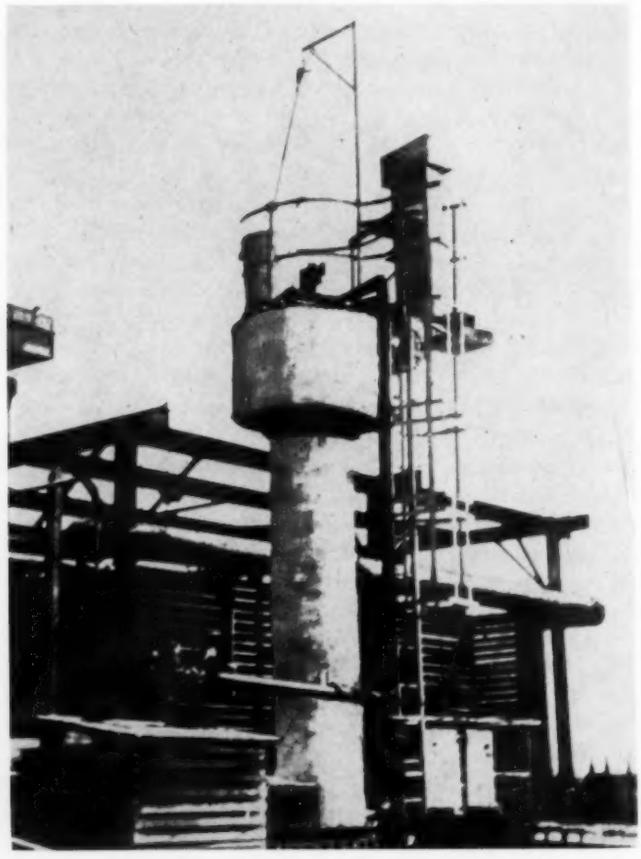


Figure 11 — Performance of sonic carbon black collection system shown in Figure 10.

particles. These forces induce oscillations of the particles, but the phase relationships and peak velocities of their oscillations, compared to the sonic field, will depend upon the ratio of the particle's mass to its drag coefficient. Because of their greater mass drag ratio,

Figure 12 — Pilot plant for sonic acid mist collection system.



the big particles will tend to stand still and not follow the velocity fluctuation of the gas. The small particles will, however, more nearly follow the gas velocity variation and therefore have a velocity of an appreciable size. Consequently, this relative motion between large and small particles in a sonic field will result in collisions, if the concentration is sizeable. As a result of these collisions, a percentage of the small particles will stick to the large particles and be collected with the same efficiency as the large ones by the secondary collector.

Figure 8 shows the three types of motion which can be induced on aerosol particles. The curve on the right shows the settling velocities computed by Stoke's law while that on the left is Brownian motion. The three in the middle represent the rms velocities for particles with a specific gravity of one, in a gas with a molecular weight equal to that of air and in a sound field of 160 decibels. These curves, incidentally, show why low, rather than high, frequencies are more favorable to agglomeration. Bigger relative velocities between ten micron and three micron particles are desirable and low frequencies give this result.

Often the concentration is not large enough and the particles, even though they have a large amplitude, do not strike many others. Moreover, the particles, even though they strike others, may not adhere. In this case, it is advantageous to add water mist to the aerosol in order to increase the concentration of large sticky particles. The resultant increase in efficiency is shown in Figure 9.

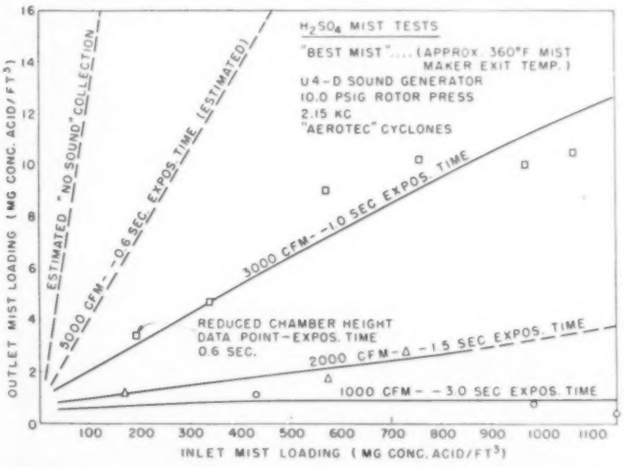
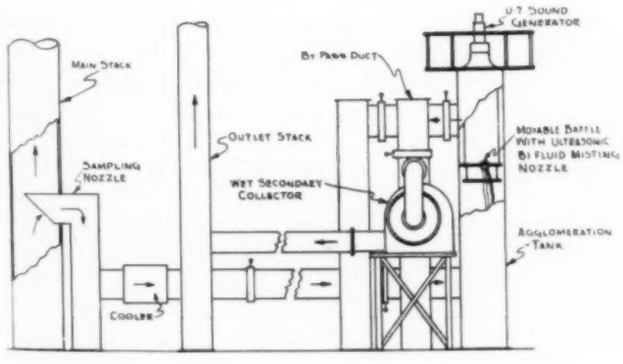

H_2SO_4 MIST TESTS
"BEST MIST"..... (APPROX. 360°F MIST MAKER EXIT TEMP.)
U4-D SOUND GENERATOR
10.0 PSIG ROTOR PRESS
2.15 KC
"AEROTEC" CYCLONES
ESTIMATED "NO SOUND" COLLECTION
3000 CFM - -0.6 SEC. EXPOS. TIME (ESTIMATED)
3000 CFM - -1.0 SEC EXPOS. TIME
REDUCED CHAMBER HEIGHT
DATA POINT - EXPOS. TIME
0.6 SEC.
2000 CFM - Δ - 1.5 SEC EXPOS. TIME
1000 CFM - - 3.0 SEC EXPOS. TIME
OUTLET MIST LOADING (MG CONC. ACID/FT³)
INLET MIST LOADING (MG CONC. ACID/FT³)

Figure 13 — Performance of sonic acid mist collection system.

Figure 14 — Schematic diagram of wet collection pilot plant for open hearth operation.



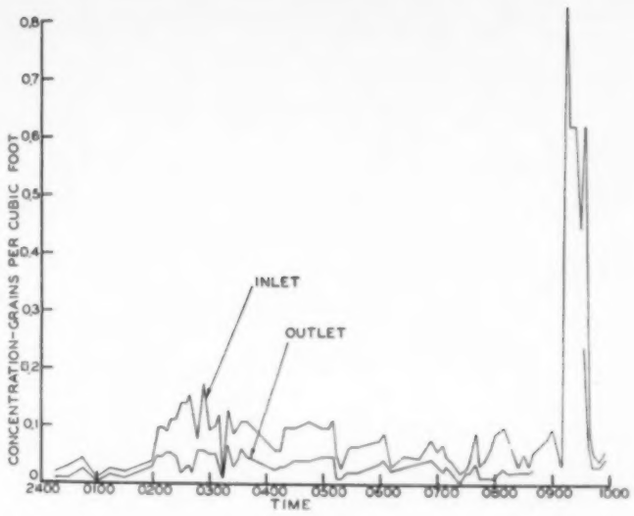
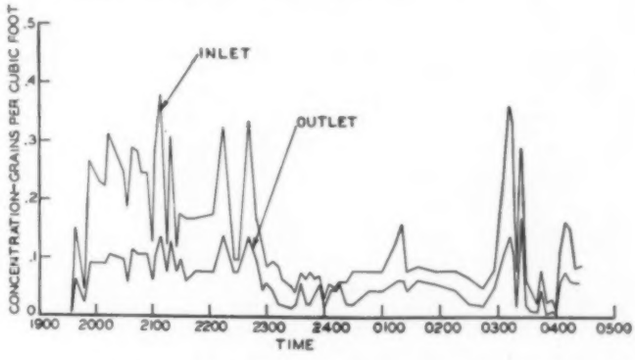


Figure 15 — Results of pilot plant tests on open hearth fume using dry secondary collector only.

Figure 16 — Results of sonic pilot plant tests on open hearth fume using dry secondary collection and sound with gas saturation.



Application — The following are some typical applications:

1. Carbon Black.

Figure 10 shows a pilot plant installation with the agglomeration vessel, and three cyclones in series, as the secondary collector. The operation of this plant is illustrated in Figure 11 where the increase in collection with increased inlet fume concentration is shown. A full scale installation has recently been constructed but the tests are, as yet, not conclusive enough to be discussed.

2. Sulphuric Acid.

A pilot plant is illustrated in Figure 12. The performance of the plant is shown in Figure 13. A full scale sulphuric acid collector has also been constructed, but the attendant test program has not progressed to such a point that the results can be discussed.

3. Open Hearth Fume.

Pilot plant tests have recently been run on an open hearth furnace. The arrangement of the test apparatus is shown in Figure 14. This test was divided into the three following groups:

a. Dry agglomeration and collection:
   A dry secondary collector was used and the fume was collected as a dry powder.
b. Semi-dry agglomeration and collection:
   A dry secondary collector was used but the gas

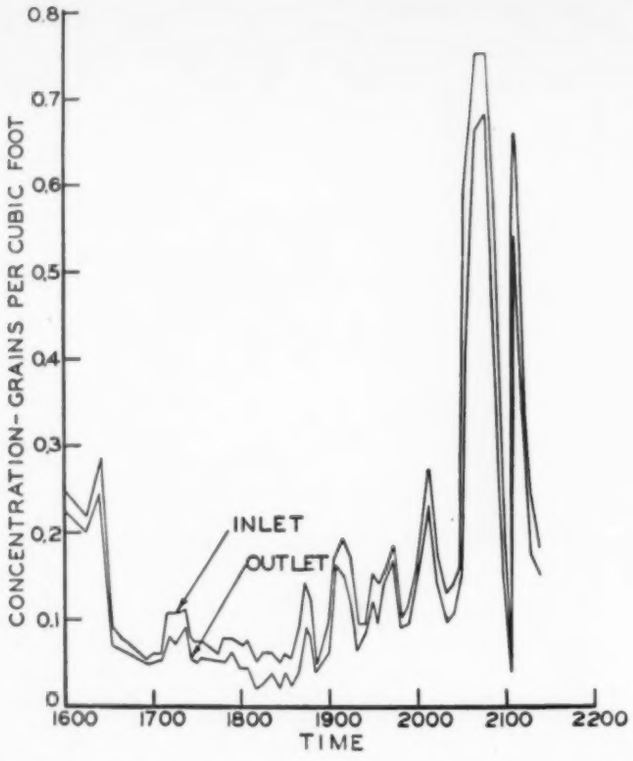


Figure 17 — Results of pilot plant tests on open hearth fume using wet secondary collector without sound or misting.

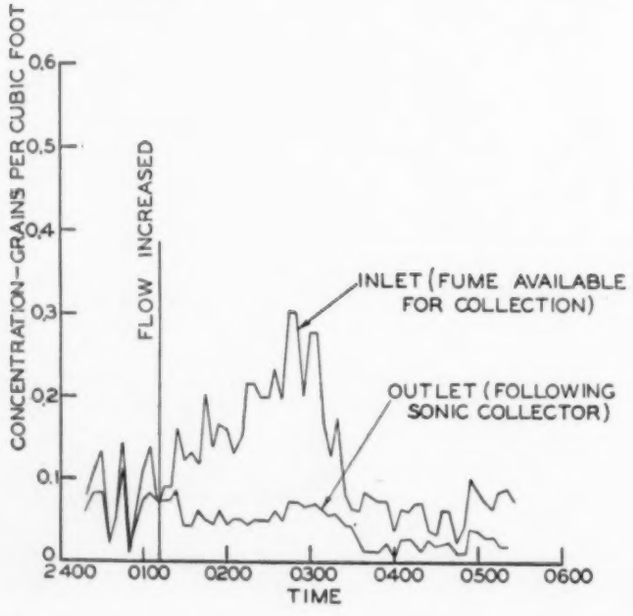
was spray saturated and the fume was collected as a moist powder.

c. Wet agglomeration and collection:
A wet secondary collector was used, the gas was spray saturated, water droplets were introduced in the tower, and the fume was collected in a slurry.

The dry tests showed that excessive powder was needed to agglomerate the fume in a dry state. The semi-dry tests are shown in Figure 15 where only the secondary collector was used. The improvement in collection with the use of a sonic agglomerator and spray saturation is shown in Figure 16. The wet test results are shown in Figure 17 where only the secondary collector was used. The improvement in collection with the use of a sonic agglomerator and spray saturation is shown in Figure 18. These results indicate that the outlet grain loading can be kept below 0.08 gr per scf for 96 per cent of the open hearth cycle and will never exceed 0.12 gr per scf. These wet tests are summarized in Figure 19 where collection efficiency is plotted versus inlet concentration.

We have made a proposed layout of a full scale installation on a 24,000 scfm open hearth furnace. The flow diagram is shown in Figure 20 while the side view is shown in Figure 21. The product from a unit such as this is collected from the drum dryer and is in the form of a dry cake. Steam consumptions are calculated to be approximately 1200 lb per hr per 1000 cfm of treated gas, or if compressed air is used, a power input of 15 hp per 1000 cfm is required.

Figure 18 — Results of sonic pilot plant tests on open hearth fume using wet secondary collector, sound and misting.



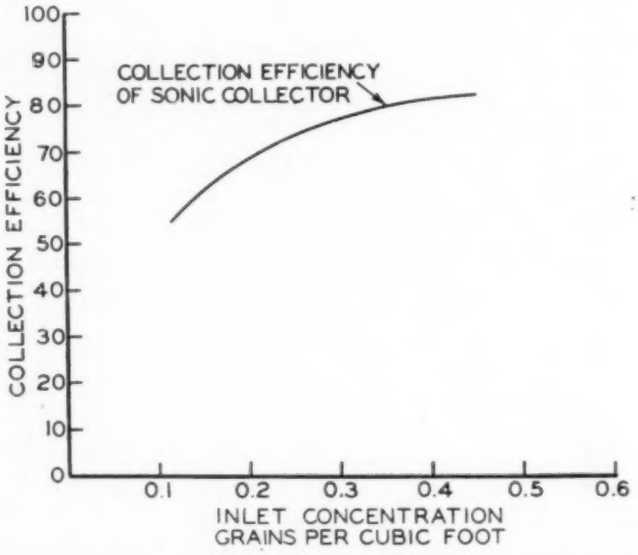


Figure 19 — Collection efficiencies from sonic pilot plant tests on open hearth fume using wet secondary collector, sound and misting.

SECONDARY COLLECTORS

From the above it is evident that these units put a premium on secondary collectors. We use an impingement separator which is a predominately open area, woven wire, inertial separator. The operation of this separator can best be visualized by thinking of an aerosol blowing upon a small cylinder or ribbon. As the air goes by, it must navigate a minute radius of curvature if the cylinder is small. The fume or mist particles are heavy enough so that they cannot navigate the curve; they impinge upon the fibre and are thereby collected.

A comparison of this separator with the conventional centrifugal separators is shown in Figure 22. Several successful installations have been made in cement kilns, oil fume collectors and spray driers for soap. The high collection efficiency possible with a sonic system is not

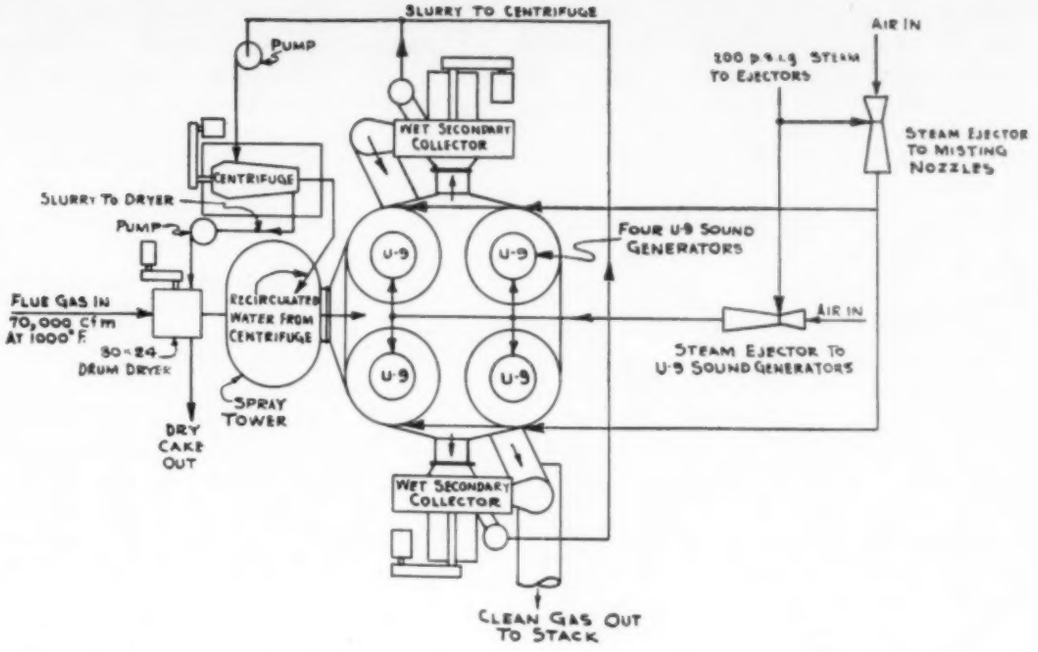


Figure 20 — Schematic flow diagram of proposed wet sonic open hearth fume collector.

needed in these locations, but that obtained with a conventional centrifugal separator does not suffice.

An extended development program has been directed toward the application of these impingement separators to solids such as cement and iron fume. The secret of its success lies in preconditioning the gases and in the proper filter washing. Cement dust has been collected in this kind of wet collector without turning the filter element into a piece of reinforced concrete. A 10,000 cfm impingement separator is now in operation in the cement industry.

LIQUID GENERATOR

Sonic energy can be used to process substances either as liquids or gases. Most of our work has been up to this time devoted to the gas phase because there has been more demand for this type of equipment. It might be well, however, to mention some of its liquid phase work.

There are innumerable uses for liquid generators such as emulsification, which is the intimate mixing of two liquids, and can be realized by a sonic system in which cavitation is present. Cavitation is low pressure vapor bubbles induced in the liquid. A phenomenon opposite to emulsification, can be obtained in a system of standing waves, and demulsification, degasing and coagulation of solids in liquids are obtained by a process very similar to agglomeration. Some thought has been given to the application of emulsification in the metallurgical industry, where molten metal can be agitated thereby producing different properties in the product metal.

Another process of potential interest to the steel industry is applied to pickling tanks and metal washing systems. Here the problem is that of keeping fresh liquid in contact with the metal part by suitable agitation. A liquid generator is an excellent means of inducing this type of mixing and serious consideration is being given to an installation of this type.

SUMMARY

This paper has only been able to mention some of the problems inherent in the collection of mists and fumes

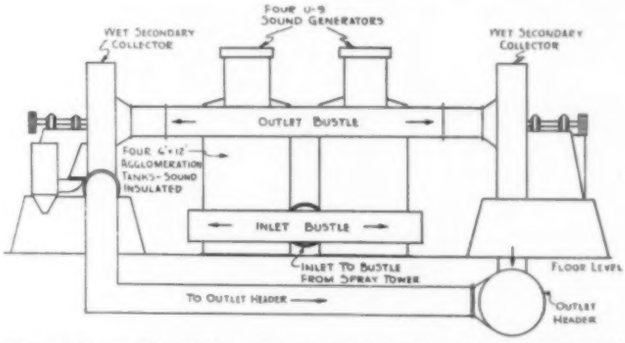
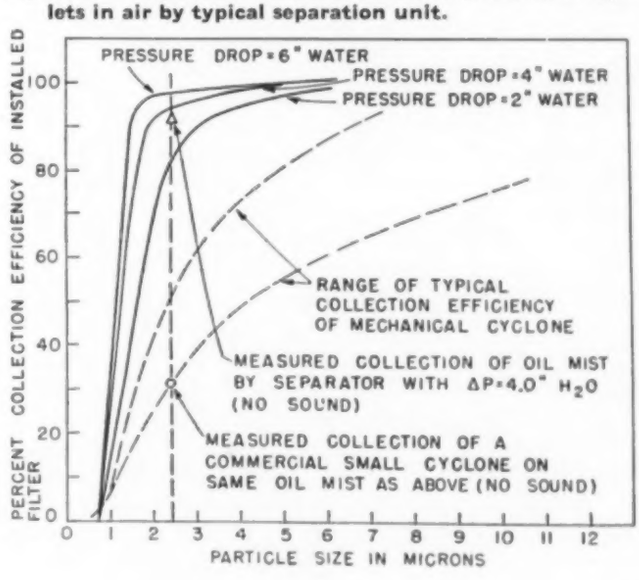


Figure 21 — Elevation of proposed wet sonic open hearth fume collector.

Figure 22 — Theoretical collection efficiency of water droplets in air by typical separation unit.


PRESSURE DROP = 6" WATER
PRESSURE DROP = 4" WATER
PRESSURE DROP = 2" WATER
PERCENT COLLECTION EFFICIENCY OF INSTALLED FILTER
100
80
60
40
20
0
RANGE OF TYPICAL COLLECTION EFFICIENCY OF MECHANICAL CYCLONE
MEASURED COLLECTION OF OIL MIST BY SEPARATOR WITH ΔP = 4.0" H2O (NO SOUND)
MEASURED COLLECTION OF A COMMERCIAL SMALL CYCLONE ON SAME OIL MIST AS ABOVE (NO SOUND)
0 1 2 3 4 5 6 7 8 9 10 11 12
PARTICLE SIZE IN MICRONS

by sonic means, and it is worth stating that the problems are far more complex than the above description indicates. There are, moreover, other applications, besides those described, which look promising, such as paper drying in the paper coating industry but these are not directly useable in the steel industry. The generation of sonic waves in liquids is an even younger art than gas phase applications, and as in all new developments the biggest uses will probably be discovered in the future.

DISCUSSION

PRESENTED BY

C. A. BISHOP, Research Associate, U. S. Steel Co., Pittsburgh, Pa.

J. MARCUS MOUSSON, II, Contract Engineer, Koppers Co., Inc., Baltimore, Md.

D. R. LOUGHREY, Superintendent, Open Hearths and Bessemer, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

T. J. BARRY, Consulting Engineer, Pittsburgh, Pa.

C. A. Bishop: In view of the interest that you people have shown in the design of these vessels in order to keep the sound intensity high, what kind or shape of vessel do you show mathematically would probably be the most efficient in giving you the maximum intensity?

C. Richard Soderberg, Jr.: The losses in an agglomeration vessel are composed of two parts, the wall losses and the port losses. The wall losses are directly proportional to wall area. If we assume that the port losses are constant, the problem is then reduced to finding a vessel with a maximum interior volume and a minimum wall area. Consequently a spherical tank is most desirable from a wall loss point of view.

J. Marcus Mousson, II: You showed grain size as a factor. Most dusts of course are not of one specific grain size, they vary over a wide range. How does it affect collection efficiency or let us say, even in mist size, how do you determine or predict the efficiency when you only know the average? Is it weighted average, or along what lines are you working?

C. Richard Soderberg, Jr.: The problem of particle size distribution is vitally important to the operation of a sonic agglomerator. Figure 8 shows the velocities of various particles in a sound field and to obtain agglomeration there must be large particles in the 5 to 10 micron size range to which the small particles of 0 to 5 microns in size can adhere, and be collected with the larger particles in the secondary collector. We have made a theroretical survey on a statistical basis and find that we can check laboratory tests when we know precisely the size distribution. However, since we virtually never have an accurate particle size determination of a proposed field installation, we are forced to resort to pilot plant tests to determine the agglomerator performance.

J. Marcus Mousson, II: You showed furnace dust from carbon black. Have you made a test on natural gas, which is of a different magnitude? It is, we would say, about a tenth lower in micron than the gas black.

C. Richard Soderberg, Jr.: We have made numerous tests on carbon black collection and find that there are two primary variables which affect their agglomeration. These are concentration and the extraction value of the black in question. Carbon black tends to agglomerate naturally, and rather sizeable variation in size can be observed by merely allowing it to flow through a duct. This is the reason for the inlet concentration being more important than inlet particle size. If the inlet grain loading is relatively large, natural growth will take place to a large extent and very few small particles can be observed. We have made tests on both gas black (low concentration) and oil black (high concentration) and find that they correlate quite nicely on this basis. The extraction value of the black is actually a measure of the stickiness of the black and hence is highly important in agglomeration. The higher the extraction value, the more readily the black agglomerates.

D. R. Loughrey: We tried the ultrasonic unit in No. 19 furnace at J&L. Earlier in the year we had heard that your company was having great success at the molybdenum plant in Washington, Pa., and were succeeding in agglomerating molybdenum oxide from the gases, to a point where it was of sandy consistency, could be shoveled back into the furnace, be re-used again as ore, and in some cases was even of higher grain size than the original ore. That sounded very encouraging to us.

We are building eleven new 250-ton furnaces at our South Side Works, and were very greatly interested in the problem of dust control. We asked the ultrasonic people to come in and see if they could do the same thing in an open hearth furnace which they had succeeded in doing in a molybdenum furnace.

We ran two types of tests with their equipment. The first collected the dust in a dry form; and the second collected the dust in a slurry. Our own interest was confined to the first test. Mr. Soderberg's paper concerned the latter. I will give a few figures on the results of the dry test. I must say first that I am not familiar in any way, shape or form with any other application of the ultrasonic siren and agglomerating tower in anything else except the open hearth furnace.

The unit was given a fair trial. We ran almost continuous tests around the clock November 6 to December 11, and additional exploratory runs to December 22. During that time we tried different types of treatment to the gases from the open hearth furnace. We ran a 20-in. sampling pipe running into the stack, Mr. Soderberg showed it on one of the charts, we ran the gases over a set of cooling pipes, and we ran them through the ultrasonic tower and then through a type "D" rotary cyclone. In between the heat exchanger and the ultrasonic tower we had fog nozzles to raise the number of particles in the gases. We found in our tests that 55 per cent of the dust is less than 5 microns in size, with 50 per cent less than one micron. The loadings also varied very greatly, they ran from almost nothing to over 1.0 gr per cu ft (standard conditions).

During these tests we found that the rotary cyclone took out considerable amount of the large material and when steam was added before the heat exchanger, a

large percentage of the dust gathered on the cold water tubes. But I must report that the ultrasonic unit itself had very little effect upon the cleanliness of the gases. In other words, if we would take a gas with sufficient steam or compressed air and water added so that the rotary cyclone would remove 50 per cent of the dust, the ultrasonic unit in operation with the rotary cyclone would increase this to about 60 per cent. In other words, the siren and tower increased the efficiency about 10 per cent.

In the dry test we checked the collecting efficiency of the units by the Brady dust sampling method, and also, by an impinger bottle train consisting of nine bottles in series filled with a solution through which the gas was bubbled. The latter takes a continuous sample for the entire heat as compared to a batch sample taken by the Brady.

The Brady tests showed an occasional efficiency up to 95 per cent with an average of 60 per cent; the impinger train showed an average efficiency of 60 per cent also. The efficiency of the rotary cyclone alone with steam or compressed air and water was 50 per cent and 60 per cent respectively as measured by the above methods.

As Mr. Soderberg suggested to you, we did alter the length of the tube in order to try to agglomerate more, we raised the false bottom from 22 ft until we had a very short tube, I believe it was somewhere around six feet, and we were not able to take out any more with the ultrasonic siren and tower.

The ultrasonic siren does make noise. We made no elaborate provisions in our test to do away with that noise. However, we understand that if properly covered with insulating material the noise will not be objectionable.

However, we have to report that on open hearth gases we did not get a high percentage of gas cleanliness, and we ran up to about 60 per cent. We found that the dust under one micron in size did not agglomerate enough to be collected. We had hoped that by varying the sound frequency and intensity and by adding water particles (steam or compressed air and water) we could cause the particles to agglomerate. However, we were not able to take out more than about ten per cent over the amount that could be taken out with a rotary cyclone.

C. Richard Soderberg, Jr.: As Mr. Loughrey says, his interest was confined to the dry tests. Our interest was focused on the wet tests because we found over the last three years that it is extremely difficult, if not impossible, to achieve any appreciable agglomeration in a dry state except in a few exceptions such as molybdenum sulfide, sulphuric acid fume or carbon black. In other instances we must add water particles for two reasons: first, we must increase the concentration of particles so as to give a high statistical basis for particle collision, and secondly, we need particles which, when collision does occur, will adhere. Water mist accomplishes this quite well as you can see by the difference between the wet and dry tests and also by the pilot tests shown in Figure 9.

I agree with Mr. Loughrey's well stated appraisal of the dry tests even though we were somewhat surprised from our past experience that agglomerators could exert as much effect as 10 per cent on a dust with as low a grain loading as was found on the open hearth stack.

The wet tests illustrated in Figures 18 and 19 show that the outlet grain loading can be kept below 0.08 grains per standard cubic foot for 96 per cent of the open hearth cycle and will never exceed 0.12 grains per standard cubic foot.

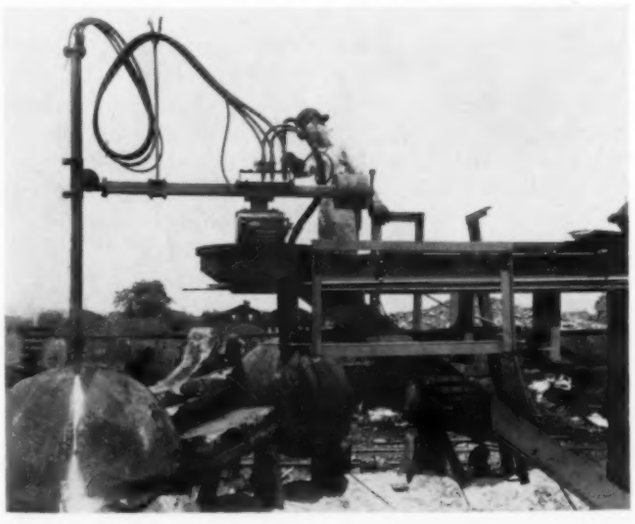
T. J. Barry: I am asking Mr. Loughrey the question. What was the difference in visibility of your effluent gas with and without the sonic agglomerator?

D. R. Loughrey: If more than 0.05 gr per cu ft (standard conditions) is left in the gases, the gases will be visible. However, even though the stack discharge is visible, we are doing the job if we comply with the code. In fact, we are within the law more than 80 per cent of the time now without any cleaning equipment.

Unless you get down to 0.05 gr per cu ft your neighbors will not know—by visual observation—that you have installed gas cleaning equipment. The remaining particles are well below one micron in size and may not fall for 50 miles from your mill, but they may not think that you are doing your job.

TURNTABLE SPEEDS SCRAP CUTTING

▲ A DESIGN feature of the scrap cutting installation at Allegheny Ludlum Steel Corp., Brackenridge, Pa., is a turntable which gives considerable flexibility to the unit. The weld machine carriage rides on a track, one section of which can be rotated horizontally — just like a railroad locomotive turntable — to any desired angle. This simple revision of a stationary cutting unit saves one or more moving operations.



With the turntable, it is not necessary to position the scrap sections after each cut in order to reduce them further. Since the direction of cut is always parallel to the alignment of the track that guides the machine carriage, cuts can be made in any direction by simply revolving the table.

Additional flexibility of operation is obtained by providing a swivel between the machine carriage and the horizontal support to which the blowpipe is attached. This makes it possible to rotate the blowpipe independently of the carriage or turntable.

NEUTRAL GROUNDING

of Low-Voltage Systems

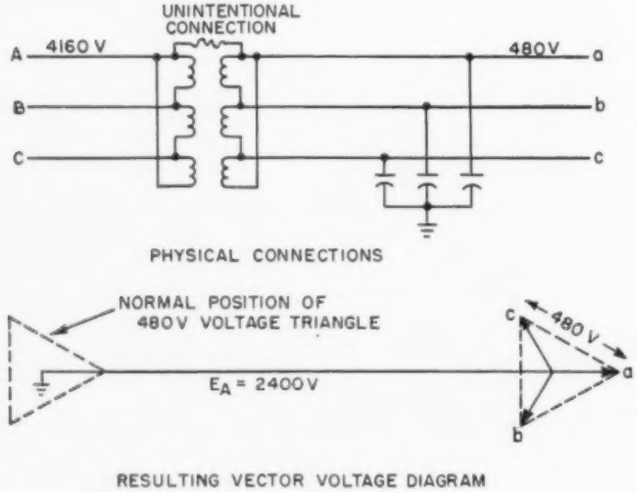
By R. H. KAUFMANN
Industrial Power Division
General Electric Co.
Schenectady, N. Y.

. . . . neutral grounding will reduce faults in transmission systems . . . .

▲ INSULATION in electric systems is under constant stress. The end of its useful life will be signaled by failure to contain the operating potential. The higher the imposed voltage stress, the shorter will be the useful life. Electric insulation exhibits the characteristics of fatigue. The break down voltage of all organic insulation materials decreases as the duration of application is increased. A given voltage applied to a particular specimen may be observed to result in failure in one cycle. A substantially lower voltage applied to an identical specimen will produce failure in five minutes. Insulation may be deteriorated by corrosive atmospheres, humidity, conductive dust, abusive service or plain old age; none the less it is the impressed voltage which finally causes failure. On a particular type of, and thickness of insulation, the higher the impressed voltage, the sooner will failure occur.

Rotating machines are critically affected by overvoltages. Each and every coil of its armature structure is literally surrounded by core iron at ground potential. An attempt to incorporate excess amounts of insulation immediately leads to severe compromises in other performance qualities of the machine.

Figure 1 — Circuit and vector diagram of an ungrounded system shows overvoltages resulting from contact with higher-voltage system.



Practical electric systems are inevitably subject to overvoltage to some degree. It becomes increasingly evident that the frequency, magnitude, and duration of overvoltages are vitally influenced by the manner in which the system is grounded. Service experience frequently contain cases of multiple equipment failures almost always associated with ungrounded systems. Unquestionably such multiple failures are associated with overvoltages of many times normal since ungrounded systems often operate with a solid ground on one conductor (73 per cent overvoltage on the other

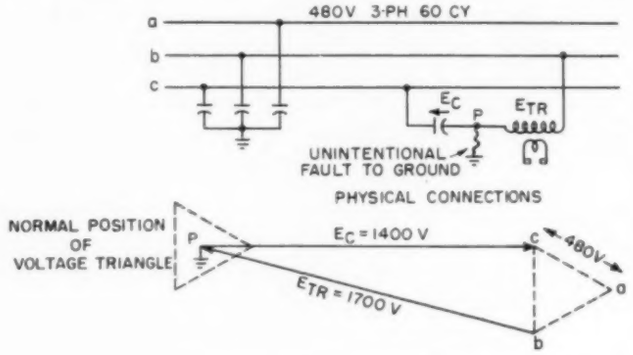


Figure 2 — Circuit and vector diagram of a series capacitor circuit shows overvoltages resulting from a ground fault.

two) for extended periods without producing a single failure.

During the last 10 years much has been learned about the nature and causes of system overvoltages. This knowledge is founded on: mathematical analysis; the results of studies using transient network analyzers; and a correlation of field service observations. Many cases of service failures can now be understood and explained which would have been baffling and mysterious a few years ago.

This better understanding of system behavior indicates that the increased overvoltage hazards of ungrounded distribution system operation far outweigh the possible benefits. As system after system is con-

verted from ungrounded to grounded neutral operation the report of the operating department is consistently the same. Much to their surprise the outage rate after grounding the system is markedly reduced. Typical of such reports is the one made by J. E. Arberry, Chief Electrical Engineer of the Pittsburgh Plate Glass Company, who in a Power Conference paper presented at Pittsburgh, August, 1950 on the subject "The Use of 600 V and 460 V Power Systems with Grounded Neutrals" drew these conclusions: "Our experience with these systems has been very satisfactory. There is no question that service reliability has greatly improved. A majority of the faults occur on branch circuits and are promptly cleared by the branch circuit protection

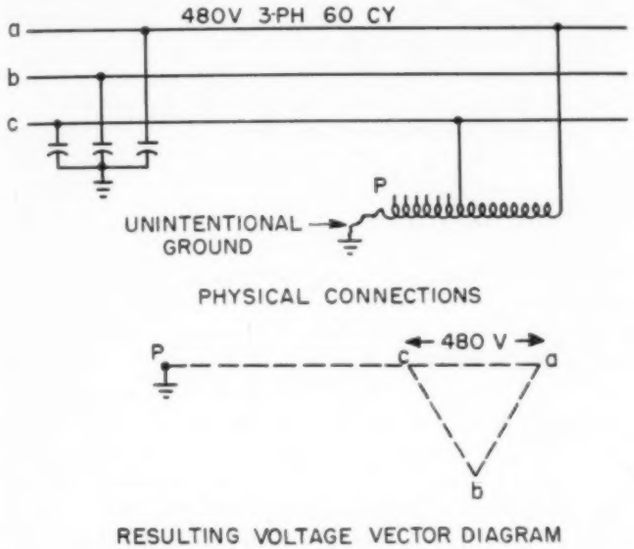


Figure 3 — Circuit and vector diagram of an ungrounded system shows overvoltages resulting from a ground fault on transformer-winding extensions.

such as fuses. Troubles are localized and promptly repaired. None of the operators has expressed any desire to return to ungrounded systems."

ORIGIN OF OVERVOLTAGES

There are quite a number of characteristic types of overvoltage sources. Lightning is a vicious source of overvoltage. By appropriate application of lightning protective equipment on the exposed incoming service lines, the overvoltages to be found within the local shielded industrial system are not excessively severe. It is the author's opinion that insulation breakdown is often incorrectly attributed to lightning. Normal power switching operations are also responsible for some overvoltage, although of minor magnitude and short duration in the vast majority of switching operations. While neutral grounding may not be effective in reducing such overvoltages it can function to divide the total overvoltage between the several phases and thus reduce the severity of the stress imposed on any one phase insulation.

There are many other overvoltage sources in which the type of grounding plays a very prominent part including:

Static.

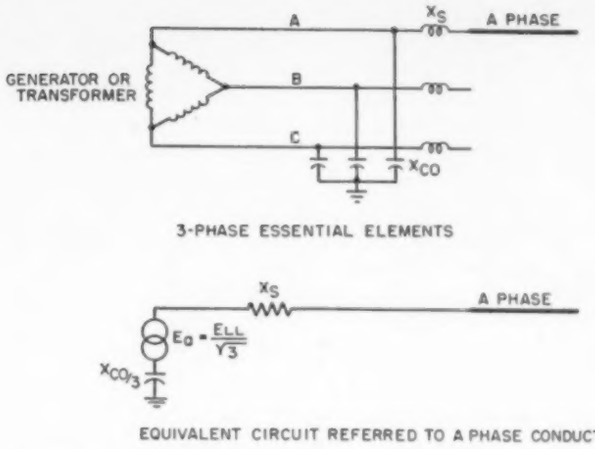


Figure 4 — Circuit diagram of an ungrounded three-phase system.

Contact with a higher voltage system.

Resonant tuned L-C load circuits.

Auto transformer applications—extended windings.

Inductive phase-to-ground connection.

Repetitive restrike—intermittent ground faults.

Static—The accumulation of static charge on electric system conductors has been found to be a source of overvoltage but is very rare in modern metal-clad circuit construction. Belt static may find its way to power system conductors if the motor frame is not grounded (the frame should be grounded). Sections of open wire line may be subject to static accumulation. At times the voltage gradient in air above ground may be quite high. Wind blown dust or sand may be highly charged.

A very "light" electric system ground connection will suffice to discharge static to ground as fast as received with practically no overvoltage on system conductors.

Contact with a higher voltage system—An unintentional connection with phase conductors of a higher voltage system can be responsible for severe overvoltages on the lower voltage system if the latter is not grounded. This may result from a conductor break on open wire circuits where both high and low voltage circuits are carried on the same poles. It may also result from a step down transformer internal failure which allows a fault arc connection to be made between high and low voltage winding conductors or terminals.

Figure 1 illustrates the conditions which exist during such a fault. The fault connection demands that the 'a' phase conductors of both high and low voltage systems come to a common potential. An ungrounded low voltage system will offer practically no opposition to a shift in its line-to-ground potentials. The vector voltage pattern will thus become that shown in the lower part of the figure. The location of ground potential (which normally is at the center of the voltage triangle) is carried far outside, resulting in line-to-ground voltages many times normal.

While fault occurrences of this character are rare, the serious consequences associated with a single experience are sufficient to cause an operating company to adopt grounded neutral operation for this one reason alone. See Case A in the appendix.

Solid neutral grounding of the low voltage system is a positive cure. Impedance grounding can also be de-

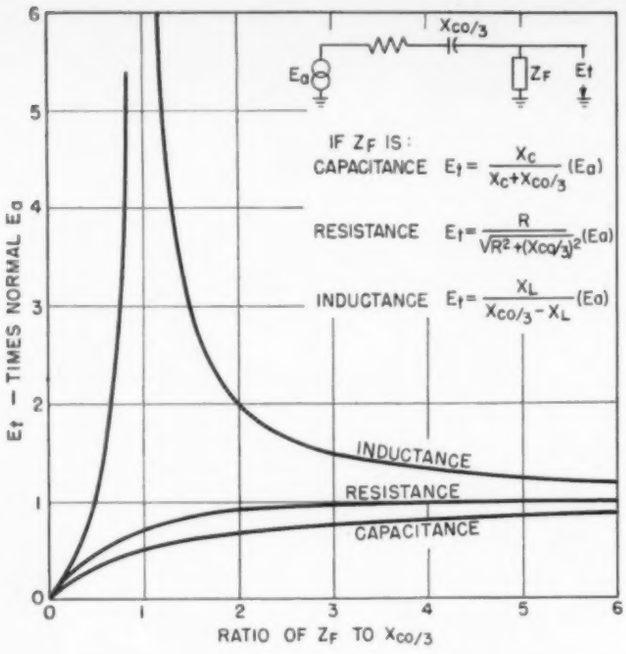


Figure 5 — Curves give ungrounded systems overvoltages because of ground fault through inductance.

pended on to hold the overvoltages to safe values if the available ground fault current on the low voltage system is made equal to or greater than the available ground-fault current of the high voltage system.

Resonant tuned L-C load circuits—Resonant tuned load circuits may be intentionally used to secure improved operating performance of utilization equipment or may be unintentionally formed by inductive and capacitive reactance in series between line conductors of the supply system. Such circuits present definite overvoltage hazards to ungrounded supply systems.

Pictured in Figure 2 is an application of a series capacitor welder. Here the tuned circuit application functions to reduce the welder demand by three or four fold and improves the operating power factor to near unity. During operation, the voltage across the welding transformer primary and the associated series capacitor are each several times the supply system rated line-to-line voltage and are almost 180 degrees out of phase with each other. The resulting vector voltage relationships are indicated on the figure. Should the junction connection between transformer primary and capacitor (point P) become grounded, it would result in displacing the line conductors of the supply system far from ground potential. In the example the line-to-ground potentials would become; 2100 volts on the 'a' phase, 1700 volts on the 'b' phase, and 1400 volts on the 'c' phase.

Grounding the supply system neutral, either solidly or through a resistance whose ohmic value is low compared with the reactance of the welding transformer or capacitor will maintain the supply system in its normal relationship with respect to ground and thus avoid system overvoltages. Should point P now fault to ground, the result would be merely a reduction of the operating voltage on the welding transformer to the system line-to-neutral value.

An experience of this type with an ungrounded low voltage supply system which, along with some other over-voltage experiences, led a large Eastern manufacturing plant to adopt neutral grounding throughout the entire system of load center unit substations. (See Case B).

Auto-transformer applications—extended windings—Any transformer application which includes a substantial winding section extending beyond the excited section represents an overvoltage menace to ungrounded neutral supply systems. These conditions may be found in the multi-tapped transformers commonly used in test or development areas. They may also be encountered in step-up auto-transformer applications as found in fluorescent or high intensity mercury vapor lighting units.

The nature of the overvoltage hazard will be evident from Figure 3. There illustrated is a transformer winding, a portion of which is excited from the 'a' to 'c' phase of an ungrounded supply system. The voltage per turn in the overhanging section will be the same as in the excited portion. The potential of the outer end (point P) will thus lie on the straight line joining the 'a' and 'c' phases but out beyond the 'c' phase potential. Should this end point become grounded, it follows that ground potential becomes pegged far outside the low voltage system voltage triangle. The resultant overvoltages on the supply system conductors to ground will be clearly evident from the vector voltage diagram. Case C reports field experience of this type.

Generally the system-to-ground capacitance inherent in the supply system will have a negligible effect on this behavior. In the case of a very small transformer having high reactance, a ground at point P would tend to cause the voltage difference from C to P to become even greater than it was prior to the ground fault.

System neutral grounding is positive insurance against overvoltages of this character. If not solidly grounded, the available ground fault current should be made at least as great as the fault current which would flow in the transformer winding extension if shorted on itself.

Capacitively grounded systems—The next two types of overvoltages come into existence only because of capacitive coupling between system conductors and ground. All ungrounded systems are inevitably and unavoidably capacitively coupled to ground. All power cables, bus structures, rotating machine windings, transformer windings, etc., each have capacitive coupling to ground which collectively fixes the total system-to-ground capacitance. Figure 4 identifies the essential characteristic elements of an ungrounded system on which the following behavior patterns depend.

Inductive reactance phase-to-ground connection—To tackle the analysis of the effect of a line-to-ground impedance fault on a three-phase system would normally call for the application of symmetrical components. In the present case it is possible to convert to a much simpler single phase equivalent circuit correctly representing the system behavior as far as a single phase-to-ground fault connection is concerned. Those who are familiar with symmetrical component analysis will recognize the same system elements in control of the symmetrical component network and will find it yields identical results.

The phase-to-ground capacitance of each phase of a

three-phase system will be practically the same. Thus in the absence of fault connections, there will appear on each phase conductor a potential of line-to-neutral value or line-to-line volts divided by $\sqrt{3}$. There is thus an effective open circuit driving voltage of $E_{LL}/\sqrt{3}$. The effective system internal impedance (relative to a single-phase line and ground) can be deduced by considering what happens if the reference phase conductor is displaced from its open circuit potential point. As the phase conductor is forced to change its potential relative to ground, it will be evident that each phase conductor will change by an equal amount. Thus a change in the line-to-ground potential of the reference conductor will be permitted by an equal voltage change on each of the three phase to ground capacitances. In other words, there appears to be a series capacitive reactance within the supply system made up of the sum total system capacitance to ground.

The resulting simplified equivalent circuit which correctly simulates the behavior of a single-phase conductor relative to ground is that appearing in the lower part of Figure 4.

This simplified equivalent circuit permits a simple direct approach to the problem of overvoltage produced by an impedance fault from one phase conductor to ground.

The results of such an analysis appear on Figure 5 for each of the basic forms of impedance; capacitance, resistance, and inductance. The phase to ground potential of the faulted phase for each type of fault impedance is expressed in general equation form. It will be noted that in each case, the voltage is controlled by the ratio of fault impedance to the system capacitive impedance, since by a minor re-arrangement of the basic equations they can be converted to:

$$\text{Capacitance } E_t = \frac{1}{1+\left(\frac{X_\infty}{3X_c}\right)}(E_a)$$

$$\text{Resistance } E_t = \frac{1}{\sqrt{1+\left(\frac{X_\infty}{3R}\right)^2}}(E_a)$$

$$\text{Inductance } E = \frac{1}{\frac{X_\infty}{3X_L}-1}(E_a)$$

A graphic plot of the phase-to-ground potential on the faulted phase discloses that a resistive or capacitive fault impedance creates no overvoltage problem. An inductive reactance fault circuit on the other hand is observed to create series resonance when the fault circuit reactance matches the total system-to-ground capacitive reactance. Excessive overvoltages are created limited only by the ratio of X to R in the series circuit which may easily be as high as 10 to 20. Furthermore, it is observed that an inductive reactance value within a two to one band (0.7 to 1.5 times $X_\infty/3$) will create overvoltages of three times normal or more.

There are quite a wide variety of circumstances which will result in a high inductive reactance fault circuit between phase conductor and ground, a few of which are illustrated by Figure 6.

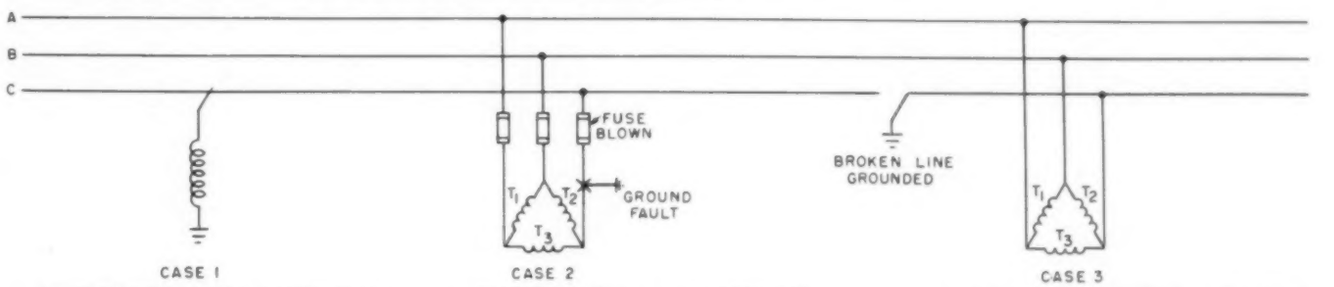
Case D and Case E in the records of field experience are examples of other forms of this mechanism at work.

Supply system neutral grounding is again a positive cure. Even a very light resistance neutral ground ($R_g \doteq 1/3\ X_\infty$) is sufficient to effectively suppress this source of overvoltage. For other reasons, it will be desirable to employ a much lower value of resistance or use solid neutral grounding.

Repetitive restrike—intermittent ground faults—For a long time it has been realized that severe overvoltages could be developed in ungrounded low-voltage industrial electric distribution systems by a sputtering or intermittent ground fault on one phase. The mechanism by which such overvoltages are generated was not clearly understood until recently. In recent years much has appeared in the technical literature on this subject under the sixty-four dollar title "repetitive restrike." The intermittent character of the fault path may be the result of vibration causing an electric conductor to intermittently make contact with ground; the result of scattering particles of molten conductor metal which intermittently establishes a conducting path to ground; or as a result of successive break down and seal off of the separating space between conductor and ground. In the last case involving a fixed separation between conductor and ground, a progressively increasing breakdown voltage across this gap is an essential element in the build-up of severe overvoltages.

An understanding of the fundamental aspects of this mechanism can be acquired from Figure 7. In "A" is shown the three-phase vector voltage pattern under normal conditions. The neutral remains at ground

Figure 6 — Examples of unintentional high-reactance connections between line and ground. (Note 1 — Wye ungrounded transformer connections would also produce the same effect.)


A
B
C
FUSE BLOWN
GROUND FAULT
BROKEN LINE GROUNDED
T1
T2
T3
CASE 1
AN INDUCTIVE WINDING ACCIDENTALLY CONNECTED BETWEEN ONE PHASE AND GROUND.
CASE 2
A GROUND FAULT AT A FUSE PROTECTED TRANSFORMER CAN BLOW ONE FUSE LEAVING THE REACTANCE OF TRANSFORMERS T2 AND T3 IN PARALLEL BETWEEN LINE AND GROUND (NOTE 1)
CASE 3
ONE BROKEN OVERHEAD LINE GROUNDED ON THE LOAD SIDE OF THE BREAK CONNECTS THE REACTANCE OF TRANSFORMERS T2 AND T3 IN PARALLEL BETWEEN LINE AND GROUND. (NOTE 1)

potential. The three, phase voltage vectors are symmetrically spaced and swing around the neutral (N) at synchronous speed.

At "B" is shown the change in vector voltage pattern produced by a solid ground fault on the a phase conductor. The entire voltage triangle has been shifted upward to bring the 'a' phase conductor to ground potential. There will be a small a-c charging current flowing in the ground fault connection (possible ½ ampere on a moderate size 480-volt system). The 'a' phase voltage is at its negative crest value at position "B" at which time the charging current to ground will be passing through zero.

Should the ground fault circuit contain a small gap or break, this point of zero current would be a likely time of current shut-off. Interruption occurs very readily since no recovery voltage tends to reappear across the gap as current shut-off occurs. This is due to the fact that the neutral maintains a constant d-c voltage to ground because of the trapped charge on the system-to-ground capacitance.

In the course of the next half cycle, the generated potential in the 'a' phase will reverse causing the voltage triangle to assume the position of the upper figure in "C." During that half cycle interval, the 'a' phase potential to ground would follow the course indicated by the dotted line. The 'a' phase-to-ground potential is now twice normal value.

Should the fault gap break down and again become conducting, the potential of the 'a' phase conductor would be abruptly yanked back to ground potential. Because of inevitable I-C constants, the 'a' phase potential would overshoot to about the position shown in the lower part of "C" and if the fault contact were maintained would oscillate between these two limits at a high frequency (possibly 50 times normal frequency).

Associated with this transitory oscillation will be a ground charging current transient oscillation of the same frequency. At the time the voltage reaches the maximum negative excursion (lower position of "C") the fault restrike current will again have returned to zero value allowing another opportunity for a current shut-off. Should an interruption occur, the neutral potential is again trapped, this time at a negative value twice the line-to-neutral crest value.

During the next following half cycle, the generated voltage in the 'a' phase will again reverse causing the 'a' to trace the course shown by the dotted line bringing the 'a' phase potential to a negative value of four times the normal line-to-neutral crest value.

Should another restrike occur and seal off at the following current zero, the system voltage triangle would be propelled to the position of the upper location in "D."

This process as here idealized has been shown to be possible of producing overvoltages of eight times normal in a time interval of less than two cycles. Under practical circuit circumstances, the ground fault may become reconducting prior to the attainment of maximum phase to ground potential thus lessening the magnitude of the high frequency voltage oscillation. Furthermore, arc extinction may not occur at the first current zero of the transient restrike current thus allowing the transient oscillation to partially decay. The build-up of overvoltages would thereby occur at a reduced rate and would tend to reach a ceiling value. System records seem to indicate that voltage magnitudes in excess of six times normal are uncommon.

The author's opinion is that overvoltages of this character are far more prevalent in industrial systems than is generally thought to be the case. Case F of the appendix reports an unusual example of this characteristic

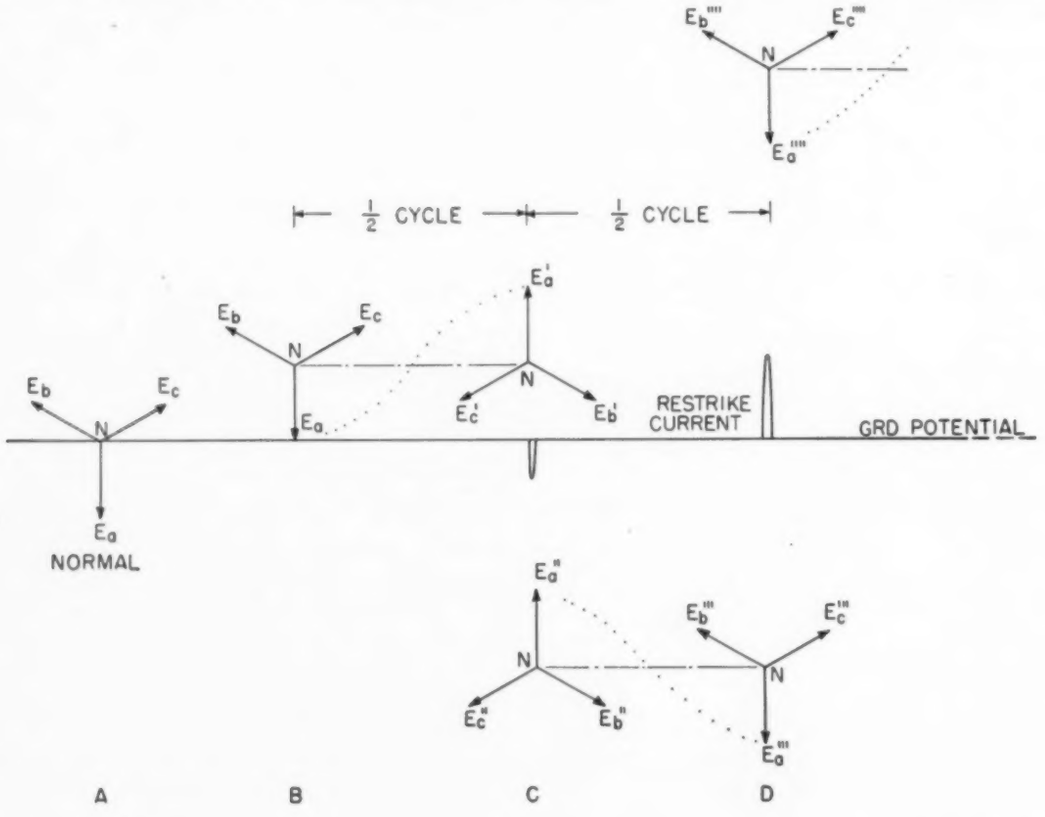


Figure 7 — Vector diagram of overvoltages developed by repetitive restrikes on ungrounded system.

type in which overvoltages of more than 4½ times normal persisted for a matter of two hours.

System neutral grounding, either solid or through resistance provides full relief from this type of action. A high resistance neutral ground ($Rg \leq 1/3\ X_{\infty}$) will prevent progressive build-up off line-to-ground voltages by successive restrike or intermittent random intervals of conduction in the phase to ground fault circuit.

CONCLUSIONS

Ungrounded industrial distribution systems are subject to severe and avoidable overvoltages. That cases of each type are occurring in service with damaging consequences is attested by actual operating system records. Electric system neutral grounding is a practical simple solution for all cases except lighting and switching surges, and even then trends more effectively to proportion the voltage surge between the phase conductors involved. Repeatedly and typically, plants which have adopted system neutral grounding, following prior ungrounded operation, report superior performance with a *lower* fault outage rate than before. Grounding of the system neutral is recommended since it results in ideal balanced voltage stress on all phases during normal operation. To assure protection from all potential sources of overvoltage and at the same time take full advantage of other desirable properties of grounded systems (reduced fault damage, prompt selective amputation of a faulty system element, improved rotating machine protection) it is recommended that load center substations, 600 volts and below, be solidly grounded and higher voltage distribution systems be resistance neutral grounded (available ground fault current equal to the largest CT rating or the ground fault current which can be supplied by a higher voltage service system, whichever is the greater).

APPENDIX

Appearing in the following list are individual examples of various types of overvoltages to which ungrounded industrial distribution systems may be exposed. The particular cases cited are illustrative and represent merely one of a family of the same type of action. There are also many system operating reports involving an avalanche of connected machine and equipment failures in which the type of origin cannot be identified, but without doubt is the result of overvoltages of many times normal.

Case A—An East Central chemical plant experienced a transformer winding failure which burned through the insulating cylinder allowing an arc contact between the incoming service 13,800-volt system and the local 2400-volt *ungrounded* distribution system. Overvoltages appearing on the 2400-volt system produced winding failures in several motors and a small turbine generator stator as well as destruction of more than a dozen 3-kv lightning arresters. Recording ammeters installed at the public utility company station indicated several short intervals of ground current flow on the 13,800 volt circuit to this plant over an interval of 15 minutes.

As a result of this one overvoltage experience, the industrial company decided to ground their 2400-volt system.

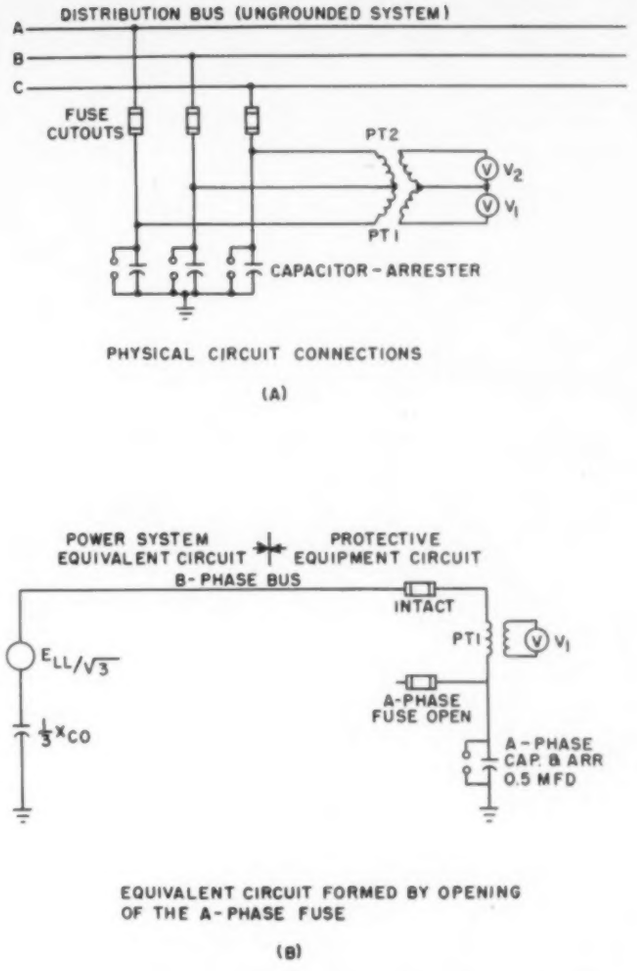
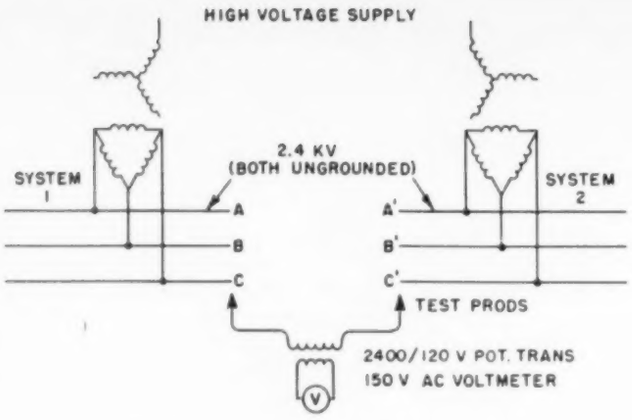


Figure 8 — Power system overvoltages can result from opening of one fuse on a bus-connected set of rotating machine protective equipment.

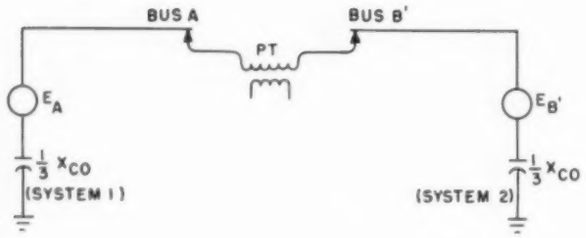
Case B—A large New England electrical manufacturing company had been operating numerous 600-volt load center systems ungrounded. A series-capacitor welder operating on one of these local systems developed a ground fault on the conductor joining the capacitor and the welding transformer. The resulting overvoltages phase-to-ground (probably five times normal or more) which appear throughout the local 600-volt system produced stator winding failures in a number of motors on that system.

This, along with other overvoltage experiences which had occurred, led the plant operating engineer to adopt neutral grounding throughout these systems. Grounding transformers were applied to stations with delta connected low tension windings. All new stations incorporate a wye connected low tension winding for direct neutral grounding. Failure rates have dropped sharply since grounding was adopted.

Case C—A metal fabricating plant in the North Central section experienced repeated multiple equipment failures on a 220-volt ungrounded service system. These troubles were finally traced to ground faults in high intensity mercury vapor lighting units. The mercury lamp unit required an open circuit operating poten-



PHYSICAL ARRANGEMENT AND TEST VOLTMETER CONNECTIONS
(A)



EQUIVALENT CIRCUIT FORMED BY CONNECTING TEST PROBES BUS A TO BUS B'
(B)

Figure 9 — System overvoltages were produced in attempting to "phase out" two ungrounded systems using a potential transformer and voltmeter for voltage measurement.

tial of 850 volts which had been established by means of a step-up auto transformer. Ground faults on conductors connected to the outermost end of the step-up auto transformers caused the supply system power conductors to be elevated to many times normal operating potential.

Grounding of the 220-volt system, it is understood, is to be adopted which will afford freedom from this as well as other types of system overvoltages.

Case D—A metal products plant in the North Central section of the country had made application of a set of rotating machine protective capacitors and arresters at the main bus of a medium voltage distribution system through a set of fuse cutouts. To monitor the fuses, two potential transformers and voltmeters had been applied on the load side of the fuses as illustrated in Figure 8A.

As a result of opening of the fuse unit in the A phase it was observed that voltmeter V_1 went off scale, potential transformer 1 overheated and melted out the compound, the gap shunting resistor on the A phase arrester was destroyed, and phase-to-ground overvoltages appeared on the phase conductors of the service system.

Not until the resulting circuit is redrawn as in Figure 8B is it apparent that the overvoltages result from series resonance.

System neutral grounding is to be adopted to insure freedom from overvoltages on the distribution system conductors. (Additional corrective measures are needed to insure freedom from overvoltage trouble in the local protective equipment circuit—potential transformer and capacitor shunting arrester).

Case E—A Western oil refinery had been operating two independent 2400-volt ungrounded systems powered by transformer banks located at the same substation. It was their intention to "phase out" the buses of these two systems preparatory to interconnecting them so as to equally divide the total load between the two transformer banks. A 150-volt, a-c voltmeter in combination with a 2400/120-volt potential transformer was arranged so that interbus voltage measurements could be made. The set-up is graphically pictured in Figure 9A.

Check readings were begun and the P. T. primary connected in successive order between buses A and A′, B and B′, and C and C′. In each case a difference in voltage of about 1300 was indicated. The next test was made connecting the test probes between buses A and B′. Simultaneously several motor windings failed and two feeder circuit breakers tripped out. (Needless to say the "phasing out" operation was discontinued at this point). It was long after this event took place that a satisfactory explanation was brought forth. As the equivalent circuit formed by interconnecting these two ungrounded systems (see Figure 9B) is examined, it is at once evident that the stage is set for overvoltage by series resonance of an L-C circuit.

The unsaturated magnetizing reactance of the potential transformer is in all probability much higher than the system-to-ground capacitive reactance. It was not until connection was made between buses with a large voltage difference that trouble occurred. As the potential transformer magnetic density is forced up into the saturated region, a much lower effective inductive reactance is encountered. Once started oscillations continue between a saturated state in the positive direction then in the negative direction, with resulting voltage oscillations in the line-to-ground voltages of both systems. (This action has been named ferro resonance.)

The origin of these system voltage oscillations is directly associated with the fact that the power systems are capacitively grounded (ungrounded). Had these two systems been either solid or resistance neutral grounded, the "phasing out" operation could have been accomplished safely without producing measurable overvoltage on either system.

Case F—A West Coast industrial manufacturing plant suffered severe prolonged experience of overvoltage of repetitive restrike origin on a 480-volt ungrounded system.

Along midafternoon one sunny day, peaceful operations became suddenly disrupted. The first evidence of trouble came in the form of a motor failure, then another, and still another in close succession. An inspection of switchboard volt meters (measuring line-to-line volts) and ammeters indicated no unusual conditions. System equipment continued to fail. A test voltmeter was rigged up having a full scale calibration of 1200 volts. Upon connecting it phase-to-ground, the pointer went off scale. A phase-to-ground potential on a 480-volt system of more than 1200 volts existed.

At once the incoming service transformers were suspected of internal breakdown between high and low

voltage windings. As the last of these transformers was isolated and individually tested, it became evident that they were not at fault. System equipment continued to fail and the situation was desperate.

A frantic group went into a huddle and decided that the only way out was to trip the main incoming service-breaker which would de-energize the entire system. At this point one of the workmen noticed a small whisp of smoke coming from a motor starting auto-transformer and upon approaching could hear a buzzing noise inside. This circuit was switched clear of the system and the overvoltages disappeared. During the two hour period that this arcing fault existed, between 40 and 50 motor windings had failed. It was found that the auto-transformer enclosing case had been bashed in and was practically in contact with the coil. The spot where arcing had taken place was evident although not badly burned.

An attempt was made to show the plant engineer what had been the trouble. A solid connection was made between the frame and the burned spot on the coil. Much to the bewilderment of the operating men and the expectations of the plant engineer, no more than the 73 per cent increase in voltage on the other two phases occurred. The main ingredient of the overvoltage (discontinuous conduction) had been omitted.

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CURRENT AISE DISTRICT SECTION MEETING NOTICES

BIRMINGHAM SECTION

Monday, March 31, 1952 — Dinner 7:00 P.M., Meeting 8:00 P.M.

"Development of Power in the South — Present and Future," by L. M. Smith, Vice President, Alabama Power Co., Birmingham, Ala.

Thomas Jefferson Hotel, Birmingham, Ala.

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BUFFALO SECTION

Tuesday, March 11, 1952 — Dinner 6:30 P.M., Meeting 8:00 P.M.

"Economic Application of Switchgear and Motor," by L. B. Gezon, Sales Manager, Switchgear Division, General Electric Co., Philadelphia, Pa.

Sheraton Hotel, 715 Delaware Ave., Buffalo, N. Y.

▲ ▲ ▲

CHICAGO SECTION

Tuesday, March 4, 1952 — Dinner 6:15 P.M., Meeting 7:45 P.M.

SYMPOSIUM

"Methods of Firing and Control of Open Hearth Furnaces."

Phil Smidt's Restaurant, 1205 N. Calumet Ave., Hammond, Ind.

▲ ▲ ▲

CLEVELAND SECTION

Monday, March 17, 1952 at Cleveland, Ohio — Dinner 6:30 P.M., Meeting 8:00 P.M.
Tuesday, March 18, 1952 at Youngstown, Ohio — Dinner 6:30 P.M., Meeting 8:00 P.M.

MONTHLY MEETING

Cleveland, Allerton Hotel, Cleveland, Ohio
Youngstown, El Rio Club, Youngstown-Warren Rd., Route 422, Youngstown, Ohio

▲ ▲ ▲

DETROIT SECTION

Wednesday, March 5, 1952, Dinner 6:30 P.M., Meeting 8:00 P.M.

"Lubrication in Steel Mills," by J. D. Lykins, Chief Lubrication Engineer, Wheeling Steel Co., Wheeling, W. Va.

Horace Rackham Educational Memorial, Detroit, Mich.

▲ ▲ ▲

PHILADELPHIA SECTION

Saturday, March 1, 1952 — Dinner 6:00 P.M., Meeting 7:00 P.M.

"Fairless Works of United States Steel Company," by J. Donald Rollins, Assistant Chief Engineer and Project Manager of Fairless Works, Manufacturing Division, United States Steel Co.

Engineers' Club, 1317 Spruce St., Philadelphia, Pa.

▲ ▲ ▲

PITTSBURGH SECTION

Monday, March 10, 1952 — Dinner 7:00 P.M., Meeting 8:00 P.M.

"Open Hearth Dust Control," by Stephen Vajda, Staff Engineer, Steelmaking, Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Movie — **"Exhaust Hoods—Design and Application,"** by Charles S. Taddonio, American Air Filter Co.

University Club, University Place, Pittsburgh, Pa.

Processing Inquiries and Orders

FOR NEW HOT ROLLED SECTIONS

By W. H. MOHLER
Superintendent, Roll Turning Department
United States Steel Co.
McDonald Plant
McDonald, Ohio

. . . . the development of a new section requires planning and cooperation by and between practically all the departments in a steel plant . . . .

▲ PRODUCERS of hot rolled sections often receive inquiries and orders for new sections that are not listed as standard products in their catalogs. A customer may require a new section for some special purpose, for example, a new crane rail, or for development of a new product or line of products, such as a new line of window sash or a new rim or hinge for automobiles. An efficient procedure of handling the inquiries and orders for these new products must be established and followed at all times. The procedure followed by one large producer of such special sections in processing inquiries and orders for new hot rolled sections will be considered here.

The presentation of a proposed section by a customer to a sales representative in a district sales office originates an inquiry. A representative, upon examining this proposed section, may recommend substitution of a standard product or substitution of an existing non-proprietary special section. If the section is such that neither of these suggestions is applicable, the representative must then determine whether the section is rollable, questionable, or undesirable. If the section is considered rollable or questionable, a print or sketch showing detailed dimensions is obtained from the customer, along with other pertinent information, and a form containing this information is filled out at the district sales office and submitted with the print to the manager of the respective sales product division of the sales department at company headquarters. Figure 1 is a sample of this data sheet. The customer's name and address are given, the name of the section and the customer's drawing or section number, the purpose for which the section is intended, and information as to whether the use is patented. Processing done to the section by the customer is also listed. The purpose and processing are requested as factors which enable the metallurgical department to prescribe the proper manufacturing practice. Following this information are the specifications to which the new section is to be developed. These are (1) the tonnages the customer expects to order per year, per rolling, and on the first rolling; (2) the lengths desired and minimum lengths acceptable, including whether he will accept multiples or shorts and details of what is acceptable; (3) the cutting specifications—namely, whether it is acceptable to shear the section or whether a special method of cutting is required, and the tolerances required on this cutting; (4) the straightening required; (5) the rolling tolerances requested; (6) the quality of steel required—this may be specified by the customer or recommended by the metallurgical department; (7) any special requirements or treatments such as pickle and oil, pickle and lime, annealing and type, branding, or any other special workmanship.

Separate product divisions handle specific grades of steel such as alloy, stainless, high strength, and carbon. The manager of the proper sales product division, upon receipt of the inquiry, develops data required by the district office. If the annual requirements are insufficient to warrant preparation of rolls, the proposition is rejected and the district office notified to that effect. Also if the submitted proposition is impracticable and proposed modifications are such as to render it unsuitable for the desired purpose, it is rejected and the district sales office so notified. If the proposition is satisfactory a new section development information sheet is prepared and along with photostats of the customer's print, is sent to the plant production planning department, cost and statistics division, headquarters production planning division, and metallurgical product unit for development of the required data.

Figure 2 is a sample of such an information sheet. Upon receipt at the plant, the information sheet contains the name of product division involved, a serial or inquiry number and the date. It also lists the customer's name, section name, steel specifications, customer's blueprint number, use for the section, estimated annual

requirements, lot size, length required, and the straightening tolerances desired. Also contained under comments is the request for any information not ordinarily given on a preliminary inquiry such as rolling tolerances required and a notation of items which might be listed under special requirements of Figure 1. Reference is also made here to previous inquiries for the same or similar sections. The remainder of the information requested on the form is developed at the plant. The copy sent to the plant is received as mentioned previously at the plant production planning department and forwarded to the rolling division superintendent. Here a hectograph original and copies are made. A copy of this is sent to the roll department, the original and a copy to the rolling mill superintendent, a copy to the works cost analyst and a copy retained by the rolling division superintendent. Workers in each department, in turn, supply the portion of the information for which they are responsible.

At the roll department comes the final decision of rollability and determination of modifications. Figure 3 shows examples of sections as proposed by the customer and as modified for rolling. If the section is considered practicable to roll, the roll pass designer must determine the mill on which to produce it. This decision results from consideration of the type of section, including its shape, width, and thickness in any particular combination, or perhaps from the lot size requested. Sufficiently large lot sizes may prompt selection of a high production mill which may have a roll change time equal to or greater than another lower production mill. If lot sizes are small, however, it would be advantageous to select a lower production mill, because it is undersirable to tie up a high production mill with numerous roll changes.

After selecting the mill on which to roll the section, a preliminary pass layout is made to determine the method of breaking down a billet or slab to produce it. Here the designer may refer to any studies of previous similar sections or inquiries listed on the information sheet or to others not mentioned there and dispense with making the layout. He may also find that a portion of the breakdown passes of an existing section may be used, and only a few supplementary passes have to be made. From the breakdown developed, the designer determines the size of billet or slab required. He also estimates, from these passes, the maximum diameter of rolls required. The weight of finished section per foot of length is next determined either by mathematically calculating the area or by planimetering it and multiplying by the weight factor per foot of length.

After this information is obtained, the designer pre-

Sales Department

NEW SECTION DATA SHEET

TO _____ DATE _____

FROM

CUSTOMER _____
ADDRESS _____
NAME OF SECTION _____
CUSTOMER'S DRAWING OR SECTION NO. _____
PURPOSE _____
IS USE PATENTED ☐ YES ☐ NO
PROCESSING BY CUSTOMER (Where possible furnish prints of finished part and show processing in sequence)

TONNAGE REQUIREMENTS
(a) Yearly _____
(b) Each Rolling _____
(c) First Rolling Desired _____

LENGTHS
(a) Desired Length _____
(b) May Furnish in Multiples of _____
(c) Minimum Length _____
(d) Per Cent Shorts Permitted _____

CUTTING
(a) ☐ Satisfactory to Shear
(b) Special Cutting if Required _____
(c) Tolerances Desired _____

STRAIGHTENING
(a) ☐ Not Required. Camber Limit _____ Max. in _____ Ft.
☐ Machine Straighten. Camber Limit _____ Max. in _____ Ft.

ROLLING TOLERANCES

QUALITY
(a) Commercial Quality (Name) _____
(b) Specification No. (if any) _____
(c) Carbon _____ Manganese _____ Phosphorous _____
Sulphur _____ Silicon _____ Copper _____
Other Elements _____

SPECIAL REQUIREMENTS
(a) ☐ Pickle & Oil (b) ☐ Pickle & Lime (c) ☐ Anneal & Type _____
(d) Branding _____
(e) Any Other Special Workmanship _____

REMARKS (Present source of supply, competitive price, special requirements not otherwise covered, etc.)

Figure 1 — Sales department data sheet shows section information obtained from the customer.

pares an estimated special section roll cost sheet. Figure 4 is an example of this sheet. Reference is made on this sheet to the associated new section development information sheet through the customer's name and section name, but more precisely through the serial or inquiry number. The roll stands are listed by name and number, in reverse order, as: Finishing, 10, 9, 8, etc., and continuing as far back as special passes are required. The diameters of the rolls required for each of these stands are listed next to them. These diameters, as previously mentioned, are determined from the preliminary pass layout. The quality of rolls to be used in each particular stand next requires consideration. In general, one particular grade is used in the finishing and leaders, and another in the remainder of the mill. There are exceptions however, where for example, a particularly deep groove exists and a tough roll of a special grade is required. Knowing the roll diameters and grades of rolls required for each stand, the roll pass designer then determines the charge for rolls. This charge consists of the cost of the rolls as purchased from the foundries. To this charge then must go the charge for turning the necks to size and for turning the necessary passes into the rolls. This work is done at the plant's roll shop.

Next to be considered are the templates. A charge must be made for the man-hours required in preparing these templates, which consist of a master or cold template, checking or mill templates, a shearknife template, and roll turning templates. The time required for necking, turning, milling if required, and for preparing templates is totaled. This total time is then multiplied by a standard hourly rate to determine the monetary charge. If branding is required, a charge may be made to cover the cost of a branding wheel or time charged

INFORMATION SHEET
NEW SECTION DEVELOPMENT

TO SUPT. PRODUCTION PLANNING
WORKS.....

SALES DIV. .....
SERIAL NO. .....
DATE.....

CUSTOMER.....
SECTION NAME.....
STEEL SPEC. .....TYPE.....
C Mn P S
Si
CUST. B/P NO. .....
COMMENTS

USE.....
EST.ANNUAL REQ. .....
LOT SIZE.....
LENGTH.....
.....
STR. TOL. .....

MILL..... WT./FT. ..... RUN OF MILL LENGTH.....
BILLET SIZE..... TONS/ROLL HR. ..... MILL YIELD.....
COND. CLASS..... PKG. SPEC. ..... FIN. YIELD.....
EQUIP. PREP.TIME..... ROLL CHG.HRS. .....
FIN.TREAT.....

STAND	NO. OF ROLLS	ROLL COST		EQUIPMENT COST
FINISHING			COST OF ROLLS TURNING LABOR (MAN-HRS.) TEMPLATES GUIDES	
			SHEAR KNIVES TOOLS STRAIGHTENING ROLLS TURNING LABOR (MAN-HRS.)	
TOTAL			TOTAL	

COMMENTS

	PRODUCTION COST	
LOT SIZE		
BILLET COST PER TON MILL COST OF LOSS MILL COST ABOVE FINISHING EXPENSE		
SHIPPING EXPENSE GENERAL MILL OVERHEAD SELLING, GENL.& ADMIN.EXP.		
TOTAL COST PER TON		
COST OF ROLL CHANGE		

SIGNED

Works Auditor

(WORKS AUDITOR RECEIVED

Supt. Prod. Plan.

APPROVED:

General Supt.

Analytical Cost Bureau

Figure 2 — Information sheet lists the new section cost data developed at the plant.

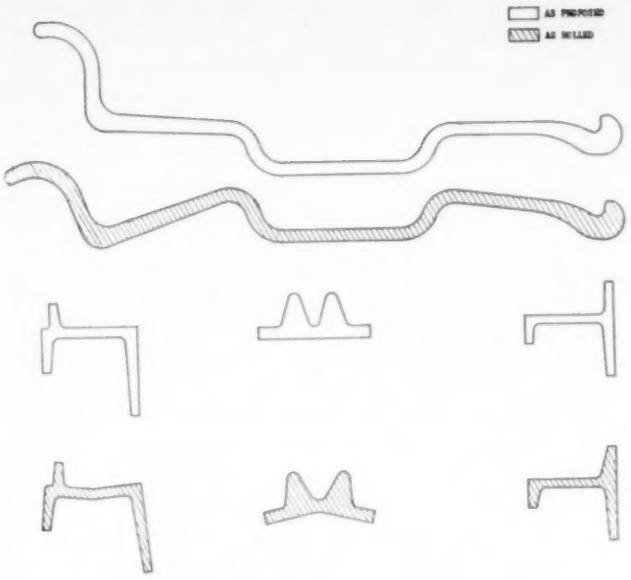


Figure 3 — Drawings of sections proposed by the customer and as revised for rolling by the roll designer.

on the branding machine. Further charges must be made for auxiliary equipment needed such as shearknives, guides, straightening passes and, last but not least, the tools for turning the rolls. The charge for shearknives is made up of the material cost, machining charge, and hardening charge. The guide costs resolve from pattern and casting costs or forging charges. If machine straightening appears to be necessary, an extra charge is added to cover the cost of the portion of a set of rolls to be used and turning the passes in these rolls. The charge for tools required in turning the roll passes incorporates the cost of the steel from which they are made, and the charges for forging, hardening, surface grinding, and grinding to shape. All of these new section charges are then totaled. Also listed on this sheet is an estimate of the time required for preparation of this equipment, a list of modifications required (or a print attached showing how it is proposed to roll the section), the weight of finished bar per foot length, and the billet or slab required. When this form is completed, it is forwarded to the rolling mill superintendent.

At the rolling mill superintendent's office the information from the roll department is transferred to the original hectograph of the new section development information sheet. Production information is estimated and also added to the information sheet here.

The superintendent must determine the length of bar to be produced on the mill cooling beds and must estimate the yield of the mill as a per cent of the billet or slab weight received from the semi-finishing mill and in tons per rolling hour. He must also determine the time necessary for changing the mill to roll the section and, if large lot orders are indicated, the internal roll change time for moving to clean passes or changing rolls when the passes are dirty. An estimate of the losses to be encountered in conversion determines the yield of the mill. A list of these losses follows: (1) scarfing losses, if required at the finishing mill, (2) furnace or scale losses, (3) mill shear losses (losses for crop ends).

Beside the losses directly attributed to the mill there are others which result if straightening, reshearing, and/or inspection are required in the warehouse. The finishing yield is estimated as a per cent of the mill yield, the reduction being due to loss in these operations. Applying the losses which are applicable, the yields and cooling bed length along with the mill change time are determined. This information is also recorded on the new section development information sheet and the sheet, in turn, sent back to the rolling division superintendent's office.

Here the class of billet conditioning requested is added to the original hectograph of the sheet. This information is obtained from the plant metallurgical department where the decision is made from information forwarded to them by the metallurgical product unit. The packaging specifications are also added here from information received from the packaging bureau. The information then contained on the sheet must be approved by the rolling division superintendent and superintendent of the plant production planning department. The hectograph original is then sent to the works cost analyst. Here the cost of the billets or slabs is added and the production figures converted to monetary values. Copies are then made and sent to the proper sales product division in the general office, plant production planning department, and rolling division superintendent. One copy is also retained by the works cost analyst.

The sales product division manager upon receipt of complete information reviews the data and, if any part of the information is questionable, discusses it with the particular unit involved until the matter is resolved. A quotation is then submitted to the district sales office covering the product description, metallurgical comment, delivery information, price, and allocation. From

Figure 4 — Form on which estimated roll and equipment costs are tabulated.

ESTIMATED SPECIAL SECTION COST SHEET

CUSTOMER

SECTION MILL DATE

Stand	Dia's	Quality	Pres Rolls	Marking	Turning	Milling	Template	Remarks
TOTALS								

TOTAL HOURS AT PER HOUR

ROLLS

TURNING PROMISE

SHEARKNIVES

GUIDES TONNAGE

STRAIGHTENING

TOOLS

TOTAL COST

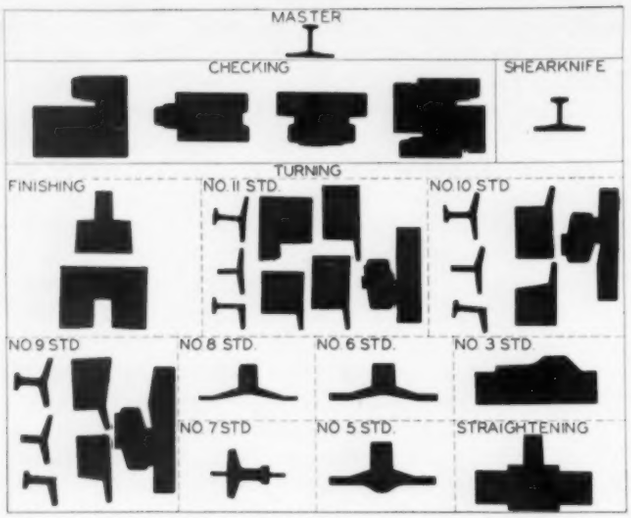


Figure 5 — Complete complement of templates required for producing one section.

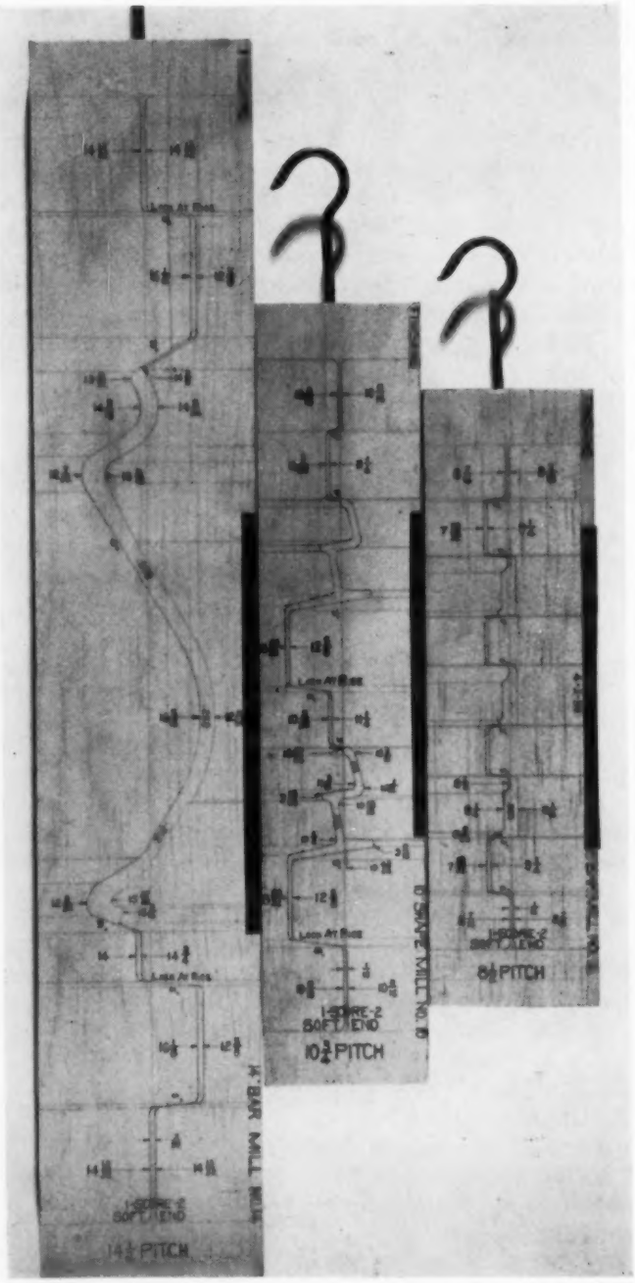
there it is submitted to the customer for his approval or rejection.

Acceptance of the quotation by the customer and the placing of an order by him begins the next phase of development. The order to proceed is received at the district sales office and forwarded to the sales product division office. Upon such notification, a section number is assigned and the personnel at the plant are notified to submit prints of the proposed section showing tolerances. These prints are prepared in the roll department and forwarded through the channels to the district sales office, together with instructions in connection with the execution of a "Standard Deposit Agreement." This agreement is the means by which the original cost of rolls and equipment which is charged to the customer is credited to him, depending on the tonnage rolled. The prints and standard deposit agreement are submitted to the customer for approval. Upon receipt of an approved print from the customer the general office accounting and production planning divisions are notified of the establishment of a new section for record purposes. The plant is also notified to proceed with the preparation of rolls and equipment.

Before any equipment can be prepared, detailed roll pass designs must be made. Many articles have been written on the considerations, problems involved, and procedures followed in this operation and will not be covered in this paper.* From the detailed pass designs the templates are made for turning the rolls. The master or cold template is made from the customer approved print. From this template, checking templates showing the limits of allowable tolerances and a template for preparing shearknives are made. The checking templates are used to gage finished bars during the rolling of an order. Figure 5 illustrates the templates required for one section.

After the turning templates are completed and approved by the roll pass designer, drawings of each set of rolls showing the passes are made on boards. Figure 6 shows the appearance of these. All boards are made as though the observer were looking at the rolls in the mill from the same position—namely, from the cooling beds looking toward the furnace. These boards show the angles at which the passes appear in the rolls, the tapers on the sides of the collars, diameters at various points on the rolls, and the direction the passes are to face in the mill. This direction is shown by always marking the top and bottom rolls with shallow grooves on the right collar. This appears as "score" on the boards. The bottom roll is always scored with one groove and the top with two. The board also shows whether this is the soft or hard (drive) end of the roll. After being completed, these boards are shellacked to preserve them and to prevent smearing. The boards are made for the convenience and use of the roll turners. They are more easily handled than paper prints, since they may be placed directly on the rolls and the rolls marked for

Figure 6 — Drawings of roll bodies, showing passes and collars, are prepared on boards instead of paper.



*See paper by author titled "*Roll Design of Small Shapes*" Proceedings Association of Iron & Steel Engineers, 1950, p 93.

cutting. This eliminates giving any dimensions longitudinally. Figure 7 shows a board on a roll illustrating how it is used. (Note the score on the right collar of the roll.) These boards are also more durable than paper prints and can be filed very compactly by attaching hooks and hanging on racks. For alterations, portions may be easily scraped clean and revised.

After the boards are prepared, the roll pass designer makes a layout showing the passes as they will appear in the rolls and giving dimensions to which the rolls should be set in the mill. With the aid of the templates and boards, the guide designer makes sketches showing how each guide pattern should be made. The boards and templates are then given to the tool maker who decides what tools are required and prepares them. The tool steel must be cut, forged, rough ground to the approximate shape of the pass, hardened, surface ground, and then finish ground to shape.

After the tools are finish ground and completed, they are used on the lathes to turn the rolls. Sufficient rolls are prepared for an initial order, including spares and straightening rolls. Lathes equipped with duplicating attachments have recently been employed for hogging and rough turning new rolls. This cutting is done to a template made of masonite, designed by the roll pass designer. Here round-nosed carbide-tipped tools are used instead of the shaped tools used on the conventional roll turning lathes. After completion of the rolls they are sent to the pattern shop along with the boards and templates. There guide and guard patterns are prepared and fitted to the rolls. These patterns are then shipped to a foundry, where guides are cast from them. Various materials are used for guides. Plain grey iron, alloy iron, and alloy steel are used, each for its particular application. While the rolls, patterns, and guides are being prepared, the shearknives are cut to shape at the machine shop to the shearknife template. They are then hardened for use on the mill. Besides the knives used at the cooling bed, knives for reshearing may also be necessary. Figure 8 is a photograph of the rolls, guides, and shearknives required for rolling one section.

As all this work is progressing on the preparation of the equipment, the billets or slabs must be secured. Sufficient steel must be ordered to make allowance for all losses listed previously and in addition make allowance for trial bars for starting the order and for cobbles during rolling. Since standard orders permit shipment of a weight of plus or minus 10 per cent, a procedure of ordering sufficient billets or slabs to supply the weight of the customer's order plus estimated losses plus 10 per cent to cover trial bars and cobbles is usually followed.

An order is placed on the semi-finishing mills for billets or slabs of proper size and composition. These mills place an order on the primary mill for the required blooms and the primary mill, in turn, will place orders on the bessemer, open hearth, or electric furnace department for the necessary ingots. The section must also be scheduled for rolling on the finishing mill in time to meet the promised shipping date. After all equipment is prepared and billets or slabs secured, the final phase of development begins.

When the development of an order is begun on a mill, the rolls are adjusted so that the proper pass in each stand is set to the dimensions indicated on the layout

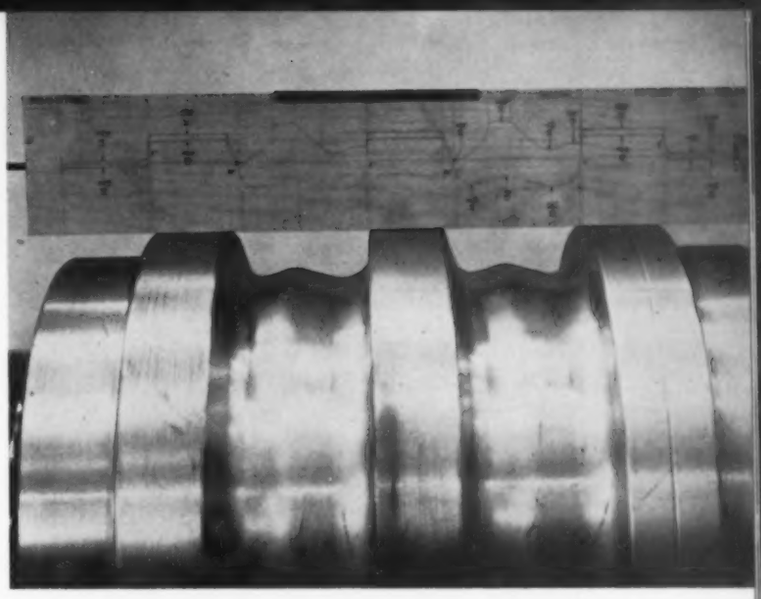
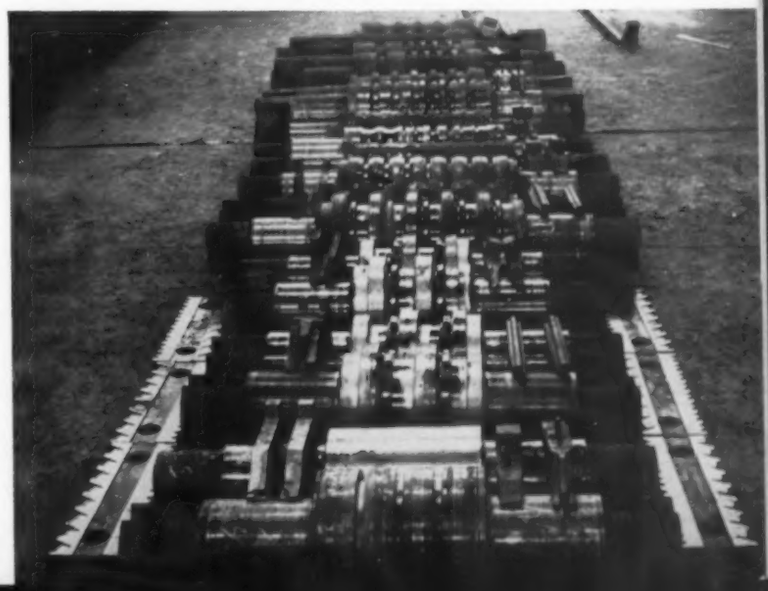


Figure 7 — A roll board on a roll illustrates how lines extended to the roll can be used for marking or turning.

prepared by the roll pass designer, and guards and guides are aligned to these passes. Much depends on the correct setting of rolls and guides in the mill to produce the desired section. Trial bars are run through the mill, test pieces cut after each pass, and these pieces examined closely after cooling. The bars are also checked while hot to be sure they will enter and deliver from each succeeding pass. When a bar is finally delivered from the finishing, it is examined closely for any surface defects resulting from the rolling and is checked with micrometers and checking templates for gage. The roller tries to eliminate any defects or out-of-tolerance dimensions by changing roll or guide settings. If this is impossible, alterations are necessary.

If the trouble is attributable to the roll passes, the roller and pass designer then confer and examine the test pieces to determine what alterations may solve the problem. If a major revision is required, the mill is changed for the next order. If only minor revisions are necessary, however, the rolls to be altered are removed from the mill and sent to the roll shop immediately. The designer makes sketches showing the alterations

Figure 8 — Complement of rolls, guides, and shear knives required for rolling a section.



to be made, and these sketches are used to alter the rolls and later the templates. After alterations are made, the rolls must be replaced in the mill and trial bars again taken. When a satisfactory section is developed, the order is rolled, sheared, conditioned, inspected or straightened (as required), packaged, and shipped to the customer.

It becomes apparent from the preceding discussion that the processing of inquiries and orders for new hot rolled sections is highly involved, and that no one individual can perform all of the functions. Therefore it is necessary that each phase of development be handled by specialists in their particular field. By this procedure intelligent and accurate service can be rendered.

DISCUSSION

PRESENTED BY

C. W. BARRETT, Chairman, Bar Mill Committee, Republic Steel Corp., Cleveland, Ohio.

C. W. Barrett: I am sure this paper will make many more familiar with the necessary steps taken to arrive at a selling cost on our special sections. The procedure varies some from one company to another. We in Republic have bar and shape mills in different parts of the country, and one of the determining factors which more or less dictates what mill will produce a certain special section is the geographical location of the customer. Naturally we prefer to produce it as near to the user as possible, if the particular grade of steel is produced in that district.

To arrive at an intelligent figure, we first of all must know what the particular mill costs us per hour to operate, and from our records and experience, we are able to closely determine the anticipated tons per hour we can produce of the section. Both the mill superintendent and the roll designer have a chance to give their approval or disapproval of the section along with their roll costs, yields, bloom sizes, guide costs, shear blades, straightening rolls, etc. These are the factors that determine the outlay of capital the customer is required to post subject to their acceptance.

One set of rolls is charged to the customer on the initial layout. All spares provided are at the expense of the plant producing the section. The cost of this equipment is re-imbursed to the customer at a specified rate per ton of product produced. So eventually, if the customer buys enough tonnage, he will be given credit for complete amount of original investment.

This subject is very important and it is imperative that we get our estimates right so we are properly reimbursed for what we produce.

STEEL PLANT WATER CONSERVATION*

▲The Fontana plant is probably the only fully integrated steel plant not located at or near a river, ocean or lake which supplies the required large volume of water for the steelmaking processes; nor on a river or outfall to dispose of used water. This plant, therefore, is faced with a water problem which few steel mill operators worry about. We read in the August 1950 volume of the "American Water Works Association Journal," page 781, that the average steel mill uses 65,000 gallons of water per ton of steel produced. Fontana recirculates 45,000 gallons per ton of steel produced, which requires approximately 2½ per cent make-up water, amounting to approximately 1400 gallons per ton of steel produced.

The water system of the plant was designed with "Conservation" as the keynote. Every expansion since the original installation was made had the keynote "Conservation of Water" incorporated in the planning.

The Fontana plant purchases water from a local water company, which was essentially a supplier of irrigation water, shares being acquired with the purchase of the steel plant site. This is raw, untreated water.

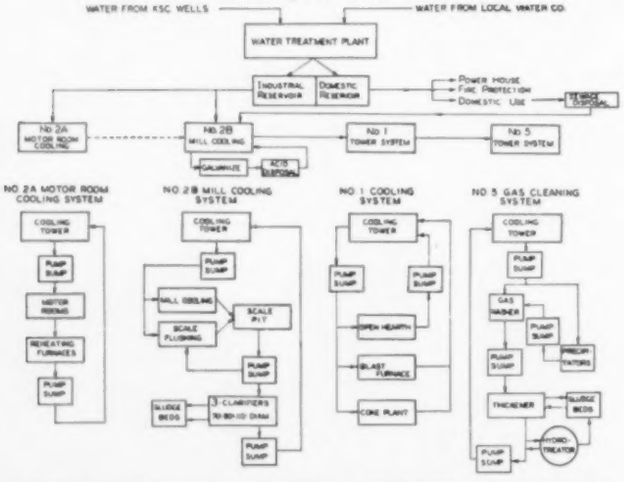
The steel plant also has two wells on the plant property which are used to supplement the water company supply.

Coal has a certain amount of moisture in it and some of this moisture is liberated to the gas in the coking process. As this gas passes through the by-products recovery plant, this moisture is condensed out and is recovered. This moisture, unsuitable for ordinary industrial cooling without expensive treatment, is collected into a sump where it is used for quenching of coke. The recovered water is pumped over the coke and the overflow allowed to return to pump sump for further use. As a result of this recovery operation, very little if any plant water is used for make-up for this operation.

Water economies which we have been able to make are the result of a number of factors. These factors are:

1. Location of plant in a water scarce area.
2. Quality of raw water available. This quality lends itself to excellent and economical treatment.
3. A good basic design of water system with flexibility available to change pattern of operation as conditions warrant.
4. An operating personnel familiar with the need for conservation and willingness to cooperate towards this end.
5. A company management which gives the necessary help to carry the program through.

Layout of water system at Kaiser Steel.



*Abstracted from paper by George B. McMeans, Works Manager, Kaiser Steel Corp., Fontana, Calif., presented at AISE 1951 San Francisco Regional Meeting.

A TRIUMPH IN ENGINEERING...

RUST

SLAB HEATING FURNACES

...with ZONE-FIRED CONTROL

DESIGN MAKES THE DIFFERENCE

Leaders in the steel industry have reason to prefer Rust's patented zone controlled, double or triple-fired, recuperative, continuous furnaces for reheating slabs, blooms, billets, bars or other shapes. No other furnace gives such positive control of heating quality and tonnage output. Each is individually designed to meet specific needs and provides 100% accuracy in the control of predetermined soaking chamber heat for any required rolling temperature. Flexibility is achieved by simply changing rate of fuel fired in the heating zone. The result is uniform heating efficiency with a minimum of fuel.

Rust Slab Heating Furnaces like other types of Rust Furnaces, meet today's demand for top performance at lower cost. There's a type of Rust furnace (designed to use any fuel) for almost every metallurgical heating need. Nearly 200 Rust installations, ranging in capacity from 20 to 115 net tons per hour, represent a considerable part of the entire heating capacity of America's iron and steel industry. For either new or modernization projects let us quote on your requirements.

THE WHOLE JOB IS ONE JOB WITH A "RUST PACKAGE CONTRACT"

ONE RUST CONTRACT covers everything . . . from blueprint to test-run. Rust assumes responsibility for design, manufacture and erection of all essential material . . . including excavations, foundations, wiring and piping. Your purchasing and engineering departments are freed of subcontractor headaches when you order from Rust.

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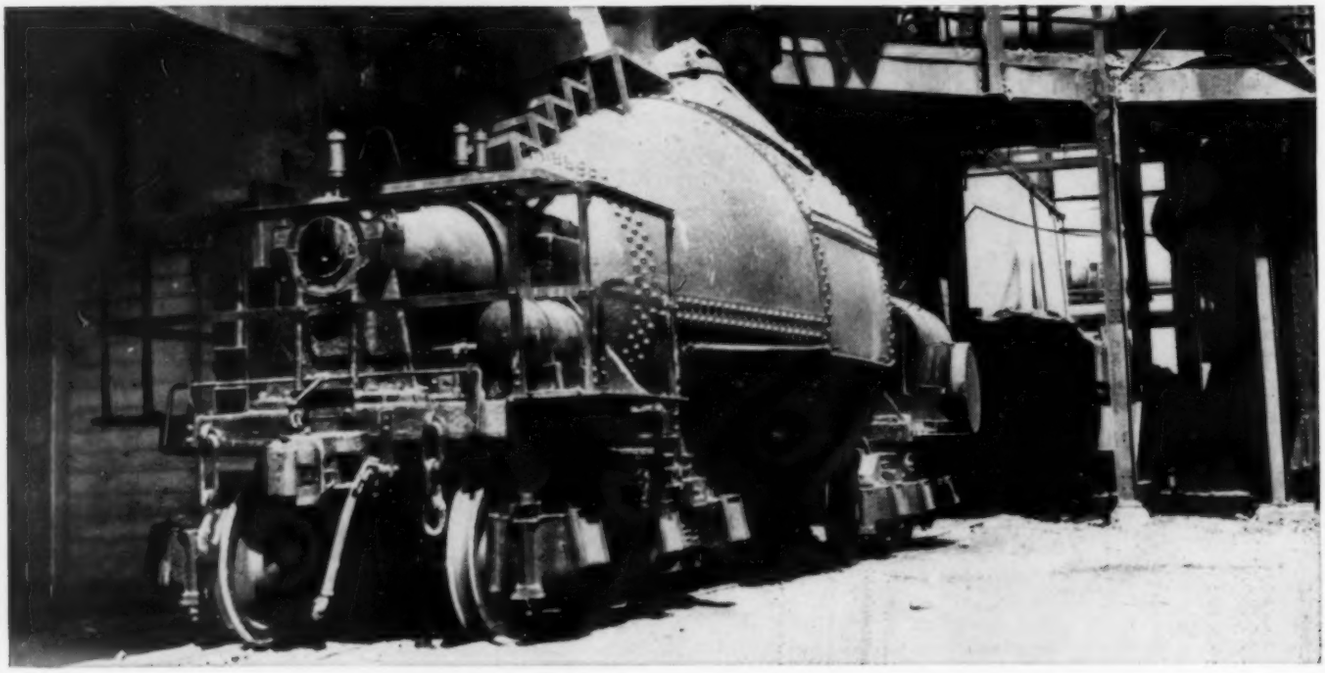
PIONEERS IN FURNACE DESIGN

PITTSBURGH, PENNSYLVANIA

Phone ATlantic 1-8870

FOUR TASIL LINED TREADWELL LADLES

Set NEW TONNAGE RECORD in Pittsburgh District!



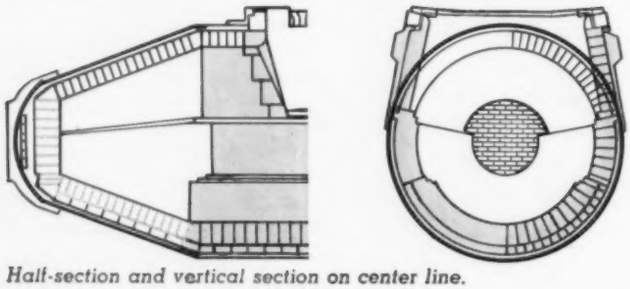
To keep a ready supply of hot metal available "BALANCE" your linings with TASIL!

RESULTS OF RECENT TEST — Pittsburgh District

LINING	AVERAGE TONNAGE BEFORE RELINED
Blast Furnace Quality Fire Brick	35,000 to 60,000 Tons
Super-Duty Fire Brick	138,166 Tons
TASIL "Balanced" Super-Duty Brick	168,305 Tons*

*Average of 4 linings.

TASIL "BALANCED" TREADWELL LADLE LINING



Half-section and vertical section on center line.

▭ – TASIL Brick and Cement

TAYLOR SILLIMANITE (TASIL) Brick and Cement extend the service life of Treadwell, Cling, and similar types of hot metal cars or ladles when used to reinforce or "balance" critical areas (see sketch). TASIL brick will not shrink or vitrify at service temperatures. Tough—they withstand the washing action of molten iron during charging, transportation and pouring.

TASIL No. 301 Air-Setting or No. 302 Heat-Setting Cement makes permanent weld-like joints and retards joint erosion. Used successfully with TASIL, bonded mullite or super-duty brick linings.

In the above test, four TASIL "balanced" ladles carried 158,017 tons, 170,156 tons, 179,609 tons and 165,432 tons respectively. The average tonnage was 21-4/5% greater than that of all super-duty brick linings. TASIL brick projected 1½" beyond adjoining super-duty fire brick when cars were taken out for re-lining.

Keep your ladles and hot metal mixers working, reduce masonry and refractory costs, keep hot metal available at the Open-Hearth—use TASIL Brick and Cement to "balance" your linings. Bulletins 314 and 315 give complete data. Write for your copies.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING AND SUPPLIES, LTD.
Hamilton and Montreal

TAYLOR ZIRCON · TAYLOR SILLIMANITE

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A SUBSIDIARY OF NATIONAL LEAD COMPANY
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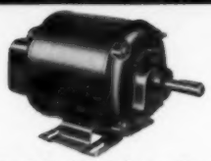
Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner Quality Motors *for your product or your plant*

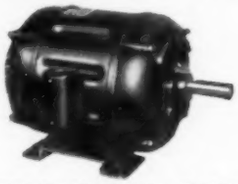
When you select a motor from Wagner's complete line, you get a motor that is completely dependable in its specific application. You can choose from a wide variety of types and sizes. Here are a few of the motors in the Wagner line. At right is TYPE RP—open type polyphase squirrel-cage motor. It is drip-proof and suitable for all general purpose applications. 1/6 to 400 hp.

SINGLE-PHASE

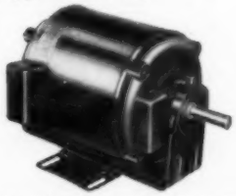


TYPE RB—*Split-phase Induction. For easy starting applications with high starting current. 1/20 to ⅓ hp.*

TYPE RK—*Capacitor-Start Induction. For general purpose applications requiring high starting torque—normal starting current. 1/6 to 3 hp.*

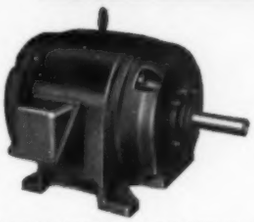


TYPE RG—*Repulsion-Induction. For high starting torque applications involving a very long starting period. 1 to 5 hp.*



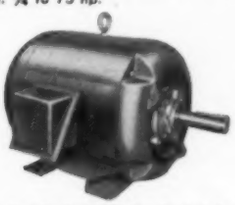
TYPE RA—*Repulsion-Start Induction. For general purpose applications with high starting torque—low starting current. ½ to 15 hp.*

POLYPHASE MOTORS



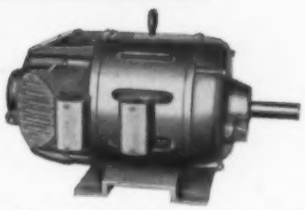
TYPE XP—*Splashproof. Protected against splashing or dripping liquids. ¾ to 200 hp.*

TYPE TP—*Totally-enclosed, non-ventilated. Fully protected. ¼ to 15 hp.*

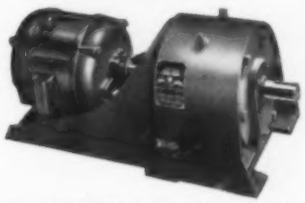


TYPE CP—*Totally-Enclosed Fan-Cooled. Protected against dirt, chips, abrasives or fumes. Steel frame. 1 to 250 hp. Also in explosion proof type HP.*

TYPE EP—*Corrosion-resistant Totally-Enclosed Fan-Cooled. Cast iron frame. 2 to 250 hp. Also available in explosion proof type JP.*



TYPE RS-1—*Wound Rotor. Constant or adjustable varying speed. 1 to 250 hp. TYPE RS-2 for intermittent service. 2 to 200 hp.*



GEAR MOTORS—*Single-phase or Polyphase. Open or enclosed types. 1/20 to 50 hp.*

DIRECT CURRENT MOTORS—*Companion line to Wagner A.C. Motors. 1/6 to 3 hp.*

* * *

In addition to a complete line of motors, Wagner also furnishes Increment Type Motor and Starter Combinations, Jet Pump Motors and a complete line of Transformers: Dry-type, Distribution and Power. Wagner engineers welcome an opportunity to serve you. Consult the nearest of 32 Branch offices, or write direct.

Wagner Electric Corporation EST. WE 1891

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6483 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M33-7

MORGOIL

ROLL NECK BEARINGS

AS the modern rolling mill was developed it became evident that an entirely new type of roll neck bearing would be required to cope with the demand for constantly increasing rolling pressures, higher speeds and closer tolerances.

Morgan undertook the development of such a bearing. Research was begun . . . and much of it was carried on in our customers' plants, at their invitation.

The first Morgoils were installed in 1932 and were at once successful. Though today the use of Morgoils is worldwide, the research and development goes on . . . in anticipation of your future needs.

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ROLLING MILLS - MORGOIL BEARINGS
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English Representative: International Construction Company, Ltd.
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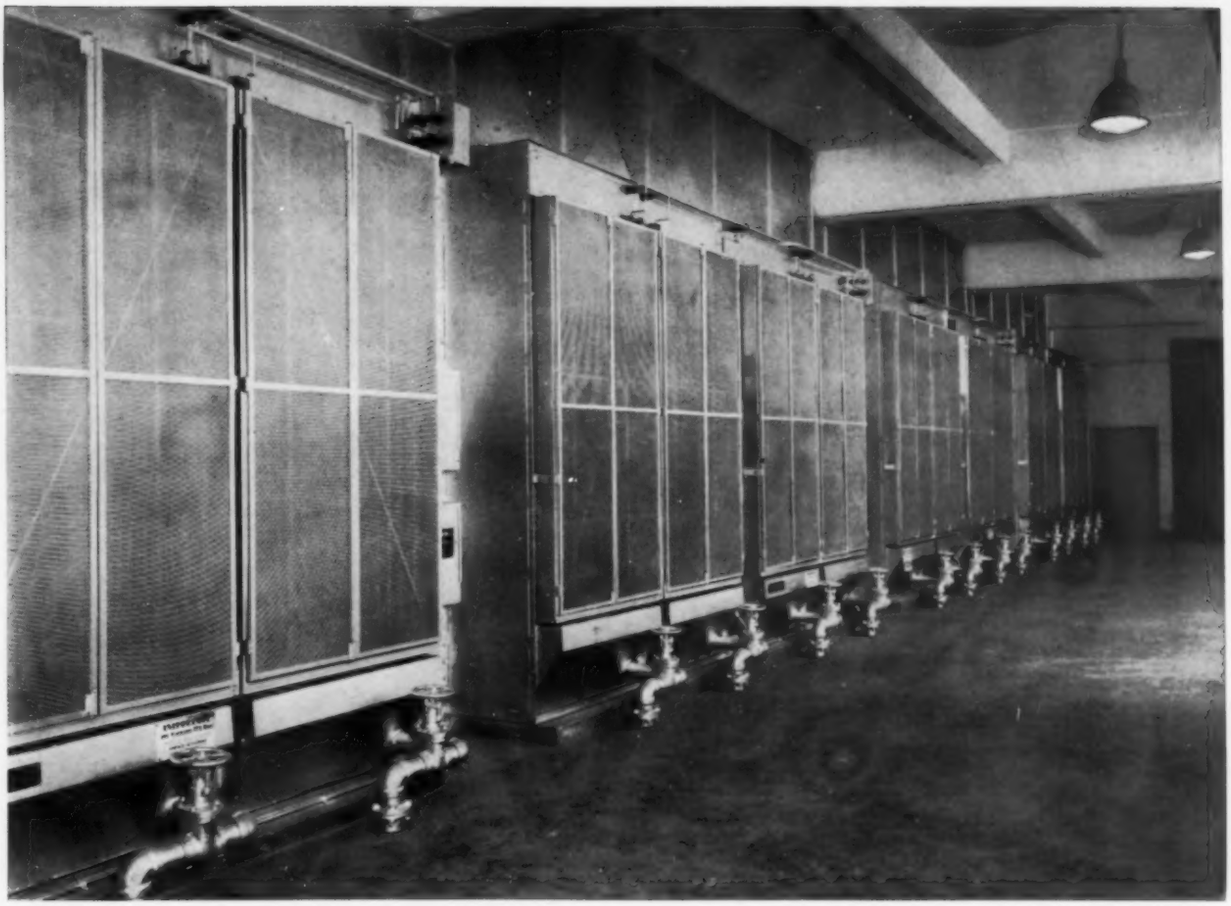
MB-19

today's best buy is better air!



AAF Electro-Matic *Precipitators totaling 175,000 CFM*

Electro-MATIC super-clean air

. . . MEANS LESS MAINTENANCE FOR MILL MOTORS!

STEEL MILL MOTORS perform more efficiently with less maintenance, if the cooling air is *super-clean.* Electro-Matic*, the *only* automatic, self-cleaning, electronic precipitator is widely used by steel mills to provide dust-free air for their motor rooms.

Highest cleaning efficiency is maintained by the Electro-Matic over a wide range of particle sizes, from smoke to the largest air-borne material. Due to the special design and spacing of its collector plates the filter curtain is non-clogging and insures uniform air volume. Also, the Electro-Matic's exclusive features of automatic operation and self-cleaning, reduce servicing to routine maintenance and insure maximum operating efficiency at all times.

The filters are standardized, self-contained sections, easily installed in various arrangements to meet any air volume requirements. Like so many in the steeel industry, the Electro-Matic installation above is equipped with oil clarifiers, which continuously clean the Viscosine and simplify sludge removal.

With thirty years experience in solving dust problems, AAF makes the *only* complete line of air filters and electronic precipitators. If *super-clean* air for motor rooms or other operations is one of your problems, call your nearby AAF representative or write today for Engineering Bulletin No. 250-E.

**ELECTRO-MATIC Automatic Electronic Precipitator.*

AAF **American Air Filter**

COMPANY, INC.

302 Central Avenue, Louisville 8, Ky. • In Canada: Darling Bros., Ltd., Montreal, P. Q.

MEXICO'S

First 4-High

Native operators at Aluminio Industrial Mexicano are sticking the Bliss mill with a relatively heavy-gage stock. They are aided by the entry back-tension bridle which offers mechanical advantage. Note horizontal duct runs of the fog exhaust system for localizing and evacuating rolling fumes.

Heavy gage coil is banded to prevent unwinding. Mill was designed to accommodate heavy and light gages of aluminum alloys.

Mill Is Bliss Built

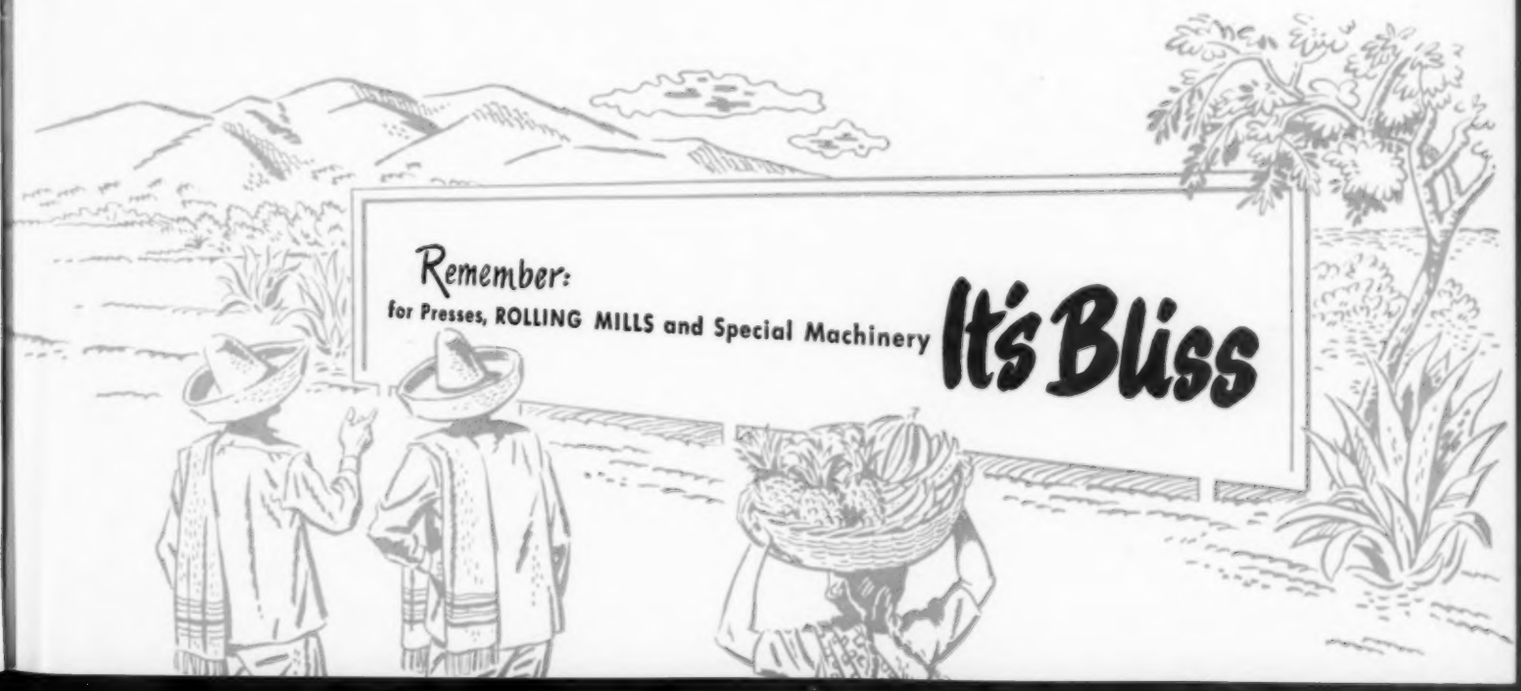
When Aluminio Industrial Mexicano, S. A., put its new four-high mill through its paces, it marked another success for Bliss rolling mill engineers. For Bliss created this versatile production unit, custom designed it for heavy and light gage rolling, and operation maintenance by native employees.

Built for both intermediate and finish rolling of aluminum alloy coiled sheet stock, the mill is equipped to give reductions up to 50% at speeds to 350 spm. Starting gage 0.100″ is generally run down to 0.019″ in 40″ widths. Complete installation includes pay-off reel, entry tension bridle, belt wrapper and tension reel rewind with unloader.

Plant officials at Aluminio report full satisfaction with the Bliss mill, the first four-high to be installed in Mexico. They find the motorized roll changer for back-up rolls "fast and convenient"...say "the unit is well tailored for local considerations... atmospheric conditions, altitude...operation and maintenance by locally-trained personnel."

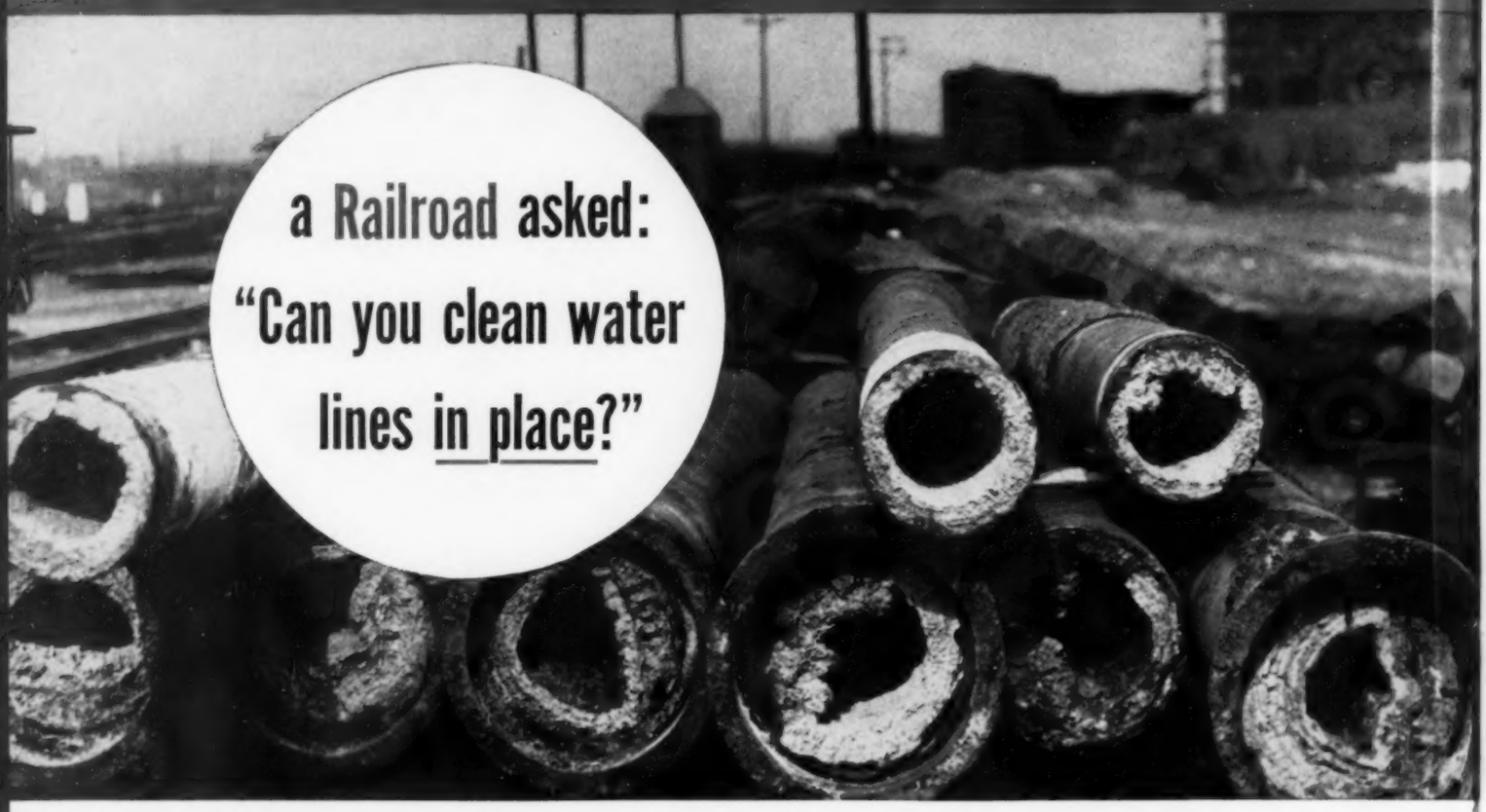
You will find similar Bliss case histories in major steel, aluminum and brass mills everywhere. Whether it's a multiple-stand tandem hot mill or an important accessory machine, Bliss engineers are interested in working with you. A good idea of the experience you draw on can be seen in Bliss' new 52-page Rolling Mill Brochure. Write for your copy today.

E. W. BLISS COMPANY, CANTON, OHIO
ROLLING MILL DIVISION: SALEM, OHIO
E. W. Bliss (England), Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France



DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service cleaned over 8600 feet of buried water line in six days!

You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service cleaned all the lines, *in place*, in only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective cleaning of pipelines—underground or above, indoors or out. No digging or dismantling is necessary. Dowell liquid solvents, designed to dissolve the accumulated deposits, are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water flow, cleaning places inaccessible to other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job, using Dowell-designed, truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned efficiently, economically by Dowell Service. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let *Dowell Service save you time and money* in maintenance cleaning!

Other recent Dowell jobs:

Water well cleaned for large utility. Original production of 1150 gpm had dropped to 550 gpm. Dowell Service brought production back to 1100 gpm.

★

Boiler cleaned for steel company. Steam production before Dowell Service: 115,000 p.p.h.; steam production after Dowell Service: 145,000 p.p.h.

★

Air cooling system on two 22,500 K.W. generators cleaned for Midwestern Utility company in four hours. Before Dowell Service, the operating temperature of the generator was at the maximum allowable of 60° C. After service, the temperature was a normal 50° C.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

CALL

New York 20	Pittsburgh 19	Ft. Worth 2	Mt. Pleasant, Mich.
Boston 16	Detroit 2	Shreveport 69	Hamilton, Ohio
Philadelphia 2	Chicago 4	Atlanta	Charleston, W. Va.
Baltimore	St. Louis 8	Indianapolis	Salem, Illinois
Wilmington 99	Kansas City 8	Louisville	Beaumont, Texas
Richmond 19	Wichita 2	Upper Montclair, N. J.	Borger, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Midland, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Wichita Falls, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Hobbs, N. Mex.

★ *Maintenance cleaning service for industrial heat exchange equipment.*

★ *Chemical services for oil, gas and water wells.*

★ *Magnesium anodes for corrosion control.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY

Date-line Diary...

January 1

▲ Happy New Year.

January 2

▲ Department of Commerce reported that construction expenditures climbed to $29,863,000,000 or 7 per cent over 1950, most of the additional dollars spent were absorbed because of higher construction costs.

January 3

▲ Phillip Murray, president of the CIO, stated that any steel wage increases must be retroactive to December 31, 1951.

January 4

▲ Republic Steel Corp. and Armco Steel Corp. jointly acquired the 15 per cent interest in the Reserve Mining Co. which was formerly held by the National Steel Corp. This gives Republic and Armco each a 50 per cent ownership of Reserve.

▲ The government wound up in the red for the first half of the 1951-52 fiscal year with a deficit of $7,467,000,000. This compares with a deficit of $559,000,000 for the same period in the previous fiscal year.

▲ DPA Chief Fleischmann predicted that military goods production in 1952 will rise to $50,000,000,000.

▲ CIO steelworkers agreed to President Truman's request and are delaying their industry wide strike for a 45-day period starting January 7.

▲ United States Steel Co. announced that it will install a third turboblower at the Youngstown, Ohio works. Estimated cost is $2,000,000.

January 5

▲ Kaiser Steel Corp. produced 962,711 tons of finished products in 1951 or 17 per cent more than 1950. Ingot production rose to 1,317,643 net tons, a gain of 15 per cent.

January 7

▲ AISI reports that companies having 93 per cent of the steel capacity will operate at 102.1 per cent of capacity for the week beginning January 7, 1952. This is equivalent to 2,041,000 tons of steel ingots and castings compared with 2,039,000 tons one week ago.

▲ NPA relaxed the controlled materials plan and abolished controls on delayed deliveries of controlled materials. It tightened up and told manufacturers that they cannot use more steel, copper, and aluminum in any quarter beginning April 1 than they are alloted for that quarter without NPA permission. In addition, small users were deprived of the right to self-certify their own priorities for metals.

January 8

▲ American Railway Car Institute announced that 8458 new domestic freight cars were delivered in December compared with 5700 in December 1950. Orders in December totaled 3309 new freight cars leaving a backlog on January 1 of 123,947 units.

▲ Production of pig iron in Canada for November totaled 223,467 tons, and steel production totaled 307,075 tons.

▲ Allegheny Ludlum Steel Corp. bought a 160-acre site on the west bank of the Allegheny River near Freeport, Pa. for future expansion. No immediate use of the site is contemplated.

January 9

▲ Lake Carriers Association reported that more bulk cargo was carried on the Great Lakes in 1951 than ever before. Total shipments were 189,000,000 tons compared with 177,000,000 in 1950. This includes coal, limestone and grain.

January 10

▲ DPA announced that civilian production will be cut back in the second quarter on homes, automobiles and appliances.

January 11

▲ DPA set production goals for sulphur of 8,400,000 tons by 1955 which is 38 per cent more than 1950 production.

▲ The AISI announced that steel production in 1951 totaled 105,133,424 tons or 8,000,000 tons more than in 1950. This is equivalent to an operating rate of 100.9 per cent of capacity.

January 12

▲ The Schuman Plan was adopted by the West German house of Parliament.

▲ DPA Chief Fleischman estimated that electric generating capacity by the end of 1954 will not meet requirements.

January 13

▲ Lukens Steel Co. reported that it ended its 1951 fiscal year on October 27 with a net income of $3,549,567 after payment of taxes. This is equivalent to $11.16 a share compared with $6.04 a share for 1950. Total sales were $80,546,418.

January 14

▲ Based on reports from companies having 93 per cent of the capacity of the industry, the operating rate for the week beginning January 14 is scheduled at 102.6 per cent of capacity. This is equivalent to 2,051,000 tons compared with 2,041,000 tons one week ago.

January 15

▲ Youngstown Sheet and Tube Co. awarded the United Engineering and Foundry Co. a contract for a 56-in. tandem cold rolling mill and two skin pass mills for its Indiana Harbor works.

▲ Steel production in Great Britain in 1951 totaled 15,638,500 tons, considerably under the 16,292,700 tons in 1950. Total pig iron production in 1951 was 9,668,800 tons or slightly higher than the 9,632,900 tons in 1950.

▲ Reserve Mining Co. at Beaver Bay, Minn. received certificates of necessity permitting it to write off 75 per cent of the $112,557,870 program to be spent at Babbitt, Minn. and Beaver Bay, Minn. Money will be used for facilities for producing iron ore. This is the largest amount allotted any company in the latest list of certificates of the DPA.

January 16

▲ United States Steel Corp. awarded the Bechtel Co. a general contract for construction of mining facilities in Venezuela. These facilities include a 90-mile railroad and highway from the mine to Puerto Ordaz on the Orinoco River.

▲ The Pittsburgh Steel Co. completed installation of its 66-in. high-lift blooming-slabbing mill at Monessen, Pa.

▲ The Bethlehem Pacific Coast Steel Corp. produced 830,846 tons of ingots from its mills in 1951, or 32 per cent ahead of the previous record in 1950.

January 17

▲ Colorado Fuel and Iron Corp. completed its acquisition of the assets of the E. & G. Brooke Iron Co. of Birdsboro, Pa. That company is being dissolved, distributing to holders of each share of its stock other stock in the Colorado Fuel and Iron Co.

▲ DPA announced that facilities expansion program covered by certificates of necessity was 35 per cent in place on September 30. Largest single program covers steel with a cost of $2,058,966,000 for steel works and rolling mills, and $339,204,000 for blast furnaces. Steel works and rolling mills program was 31 per cent complete and the blast furnace program was 12 per cent finished on September 30.

January 18

▲ AISI announced that official steel capacity in the United States increased to 108,587,670 tons effective January 1. This is an increase of over 4,300,000 ingot tons. Blast furnace capacity went up 1,310,560 tons to 73,782,340 tons. Coke oven capacity increased 800,000 to 67,060,240 tons.

January 19

▲ United States agreed to allocate to Great Britain 800,000 tons of steel and in return the United Kingdom will give or allocate 27,000 tons of aluminum and 20,000 tons of tin in 1952. In addition, Great Britain will be allowed to get 200,000 tons of steel scrap and pig iron.

January 21

▲ Commerce Department reported that United States national income rose to an annual rate of $278,000,000,000. Corporation profits after third quarter taxes were at an annual rate of $16,000,000,000.

▲ Babcock & Wilcox Co. produced seamless stainless steel tubing on its new hot extrusion facilities.

▲ The AISI reports that the operating rate of the steel industry for the week beginning January 21 will be 99.4 per cent of capacity. This is equivalent to 2,065,000 tons of ingots and castings compared with 2,051,000 tons one week ago.

January 22

▲ President Truman proposed a budget of $85,400,000,000 for the fiscal year starting next July 1. Estimated deficit would be $14,400,000,000. The president also requested an additional $5,000,000,000 tax increase.

January 23

▲ F. W. Dodge Corp. reports that total construction awards for the 37 states east of the Rockies amounted to $15,751,131,000 in 1951 or 8 per cent more than 1950.

January 23

▲ Detroit Steel Corp. plans to issue 600,000 shares of a new $25.00 par convertible preferred stock and also $25,000,000 of first mortgage bonds. Proceeds will be used to complete financing of company's $55,000,000 expansion program.

▲ American Zinc Institute estimates that zinc production in 1952 will be 1,100,000 tons or somewhat higher than in 1951.

▲ Canadian dollar sold at par with the United States dollar.

▲ The RFC increased cost of tin to U. S. industry 18½¢ or up to $1.215 a lb.

January 25

▲ Canada and the United States reached an agreement by which Canada will ship 79,100 tons of copper to the United States this year or about 16,000 tons more than in 1951. Zinc imports from Canada will rise to 184,000 tons or up about 32,000 tons from last year.

▲ Special Master Albert H. Aston of the U. S. District Court in Scranton ruled that the sale of the Williamsport Wire Rope Co. to Bethlehem Steel Co. in 1937 was accomplished through fraud and bribery. Bethlehem will appeal.

January 26

▲ Economic Stabilizer Putnam told Congress that the steel industry could absorb a certain amount of wage increase without raising steel prices.

January 28

▲ Arthur B. Wiebel, president T.C.I., announced that northern ores will be shipped for a test program to be used with the lean ores in their furnaces. Test work will be done to test the feasibility of blending ores which may later come from the Venezuela district.

▲ Based on companies having 93 per cent of the steel capacity of the industry, the operating rate for the week beginning January 28 is scheduled at 100.1 per cent of capacity. This is equivalent to 2,079,000 tons of steel ingots and castings compared with 2,065,000 tons one week ago.

January 29

▲ NPA dropped controls on chrome stainless steel because output exceeds current demand.

▲ Copperweld Steel Co. is planning an expansion program which will cost from $6,000,000 to $10,000,000 at the Warren, Ohio plant. Plans call for facilities for high alloy seamless tubing.

▲ The Weirton Steel Co. put into operation a detinning plant which is the only one of its kind in the country. Plant will recover annually 300,000 lb of tin and 30,000 tons of high quality steel scrap.

▲ The AISC reports that shipments of fabricated structural steel in 1951 totaled 2,702,262 tons or the largest since 1930. Shipments in December were 202,679 tons. Bookings in December were 202,835 tons leaving a backlog on December 31 of 2,670,202 tons. Total bookings in 1951 totaled 2,931,072 tons.

January 30

▲ Wheeling Steel Corp. reported profits after Federal taxes of $17,392,959 for 1951 compared with $18,314,517 in 1950. Gross sales totaled $227,075,571 in 1951 compared with $184,802,615 in 1950.

January 30

▲ United States Steel Corp. reported income for 1951 of $183,953,202 on sales of $3,524,978,527. This compares with income of $215,464,142 on sales of $2,956,406,146 in 1950. Increased Federal income taxes reduced the net profits.

▲ Jones & Laughlin Steel Corp. reported net income for 1951 of $30,998,000 compared with $39,744,000 in 1950. Sales in 1951 totaled $564,330,000 compared with $487,451,000 in 1950.

▲ Inland Steel Co. approved plans for a $50,000,000 financing program consisting of $25,000,000 of first mortgage bonds and $25,000,000 of convertible debentures to be offered to stockholders.

▲ Inland Steel Co. reports net income in 1951 of $34,398,585 or $7.02 a share compared with $7.76 a share in 1950. Sales in 1951 were $520,211,003 compared with $459,253,586 in 1950.

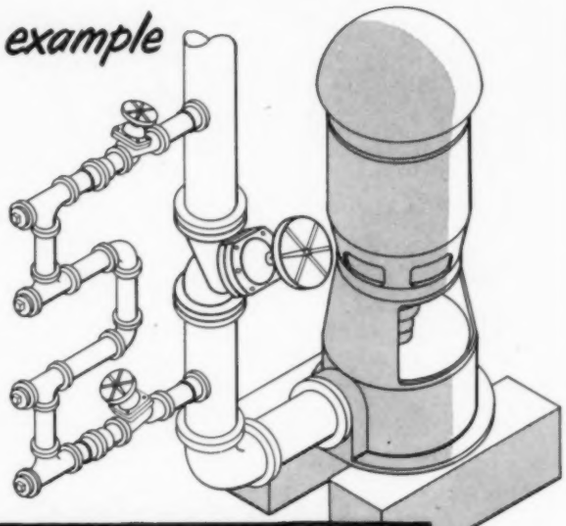
▲ OPS officials predicted that steel prices will be raised under the Capehart formula.

January 31

▲ Manufacturers' inventories had their biggest increase in history in 1951 when book value rose to $41,900,000,000 or a gain of $8,600,000,000 during the year.

▲ Bethlehem Steel Corp. reported that profits for 1951 dropped to $10.43 a share compared with $12.15 a share in 1950.

How's This For Solving a Valve Problem ...on Corrosive Well Water, for example



THE INSTALLATION

On outlet of well water pump supplying plant of Barr Rubber Products Co., Sandusky, Ohio. Sulphur content of water extremely high.

VALVE SERVICE RATINGS

SUITABILITY:	Just what was needed
MAINTENANCE COST:	None to date
CORROSION-RESISTANCE:	No evidence of corrosion
SERVICE LIFE:	Outlasted any 2 other valves so far
OPERATING RESULTS:	Pump shutdowns for valve repairs stopped
PRICE:	Much less than alloy valves
AVAILABILITY:	Stock item in Crane line

THE HISTORY

Valves formerly used here lasted no more than 6 months. Under constant exposure to severe erosive and corrosive effects, they failed to provide the easy operation and positive seating needed in this service. They required excessively frequent re-packing and seating maintenance.

Problem solved by replacing with Crane Packless Iron Body Diaphragm valves in main line and by-pass. Installed more than a year, they show no corrosion, no effects of service. Operate smoothly, seat tightly, with no maintenance needed to date.

THE VALVE

Crane No. 1611 Iron Body Packless Diaphragm Valves featuring separate disc and diaphragm. No packing to maintain; no stem leaks. Neoprene diaphragm used to seal bonnet only. Independent disc with neoprene insert insures positive seating even should diaphragm fail. Also fully neoprene lined valves. Many common and corrosive services. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why,
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

PLATE HANDLING CRANES

When your Plate Handling Cranes are "Shaw-Box," they are engineered for dependability, and built to deliver long years of outstanding service. They completely meet all demands of tough lifting operations, with a minimum of attention and under the most severe operating conditions.

Building Steel Mill Cranes has been a "Shaw-Box" specialty for many years. The cranes they produce are well known for the fine engineering details and precision workmanship employed in the interpretation of individual mill or AISE crane specifications. The dependability of "Shaw-Box" Steel Mill Cranes has been thoroughly proved by years of hard, round-the-clock use in many mills.

These features and advantages add up to reliable, economical crane service. All "Shaw-Box" Cranes are available at attractive prices.

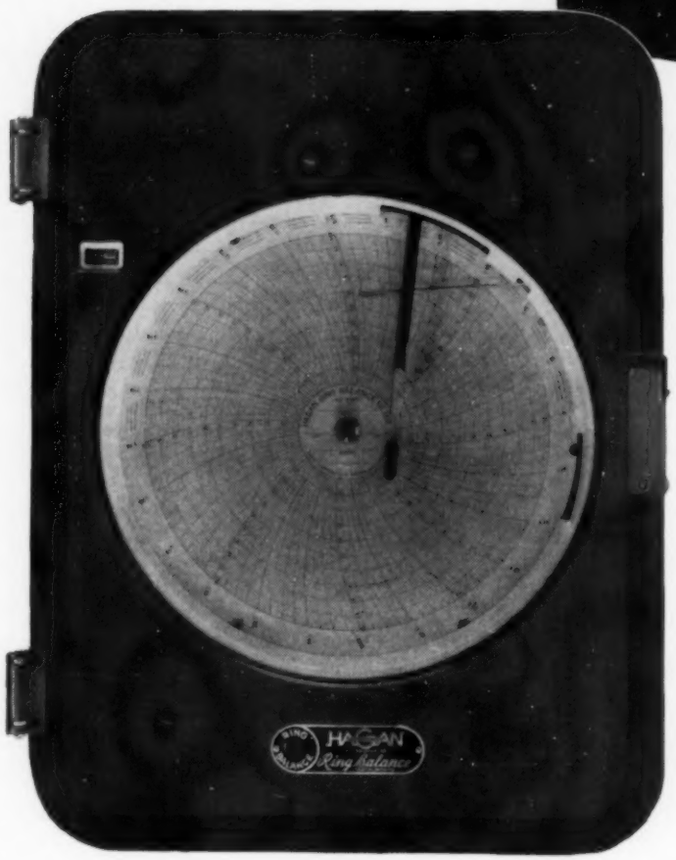
Be sure to send all your inquiries for Steel Mill Cranes and Soaking Pit Carriages to "Shaw-Box."

MANNING, MAXWELL & MOORE, INC.
SHAW-BOX CRANE & HOIST DIVISION
MUSKEGON, MICHIGAN

Builders of "Shaw-Box" Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties. Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, and 'American' Industrial Instruments.

No stuffing box troubles in

HAGAN RING BALANCE METERS



because there are no stuffing boxes!

Forget about stuffing box troubles and pressure tight bearings when you install Hagan Ring Balance Meters. The simple, flexible S-tube connections to the ring assure dependable accuracy and trouble-free operation.

Features of the Hagan Ring Balance Meter include:

- **Calibration can be checked under operating conditions by check-weight method**
- **Excellent response at extremely low flow rates**
- **Mercury level not critical**
- **Full-scale chart differential is adjustable over a 7-to-1 range**

HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PENNSYLVANIA

Our engineers will be glad to show you how Hagan Ring Balance Meters can help solve your metering problems. Use the coupon, or write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

Hagan Corporation
Hagan Building • Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in .....

.....

NAME .....

POSITION .....

COMPANY .....

STREET AND NUMBER .....

CITY ..... ZONE ..... STATE .....

Is OVERHEATING your magnet problem?

The husky load of scrap in the photograph weighs practically the same as the first load lifted eight hours earlier. Why?

Ohio Magnets lift efficiently—*uniformly*—over extended periods of operation because they operate *cooler*. Copper coils are heavier-duty, carefully sealed with plenty of non-cracking asphaltum.

Uniform lifting capacity is one of the reasons why more mills are standardizing on Ohio. Satisfy yourself. Send your next order to Ohio—*27 years a leader in magnetic materials handling.*

This magnet lifts big loads all day long!

OHIO PROTECTO-WELD MAGNET is welded *on top*, where weld cannot be dented in. Sizes include 39, 46, 55 and 65-inch diameters. Ohio also builds magnet control equipment.

In addition to lifting magnets and control equipment, Ohio Electric also makes fractional horsepower motors, heavy duty electric cable hoists, nail-making machines and drill presses.

THE OHIO ELECTRIC MFG. CO. • 5900 MAURICE AVENUE • CLEVELAND, OHIO

CHESTER BLAND, *President*

Ohio ELECTRIC

A-5127

Industry News...

WHEELING STEEL CORP. HAS INSTALLED COMPLETELY AUTOMATIC SCRAP BALER

▲ Wheeling Steel Corp. recently placed in operation at its Beech Bottom, W. Va., plant a new and completely automatic scrap baler—the result of nearly two years' engineering and development work. This new scrap baler produces bales of steel scrap that are more uniform in size and weight and of a much greater density than heretofore possible.

Where baling machines now in general use produce bales with a density varying from 14 to 30 per cent, Wheeling Steel's new installation compresses steel scrap to a density of from 45 to 70 per cent, depending on the type of scrap on hand.

Loose scrap fed into the baler box —90 in. long, 48 in. wide and 30 in. deep—is crushed and "squeezed" into approximately an 18-in. square block weighing between 600 and 1000 lb.

Three hydraulically operated rams, developing 225 tons, 400 tons and 750 tons of pressure respectively, quickly transform a tangled mass of sheet steel trimmings into a highly compact and easy-to-handle block of scrap. A fourth ram exerting a pressure of 50 tons opens and closes the baler box, the top of which is flush with the floor, and pushes the bales out of the way. The entire operation from loose scrap to finished bale consumes less than three minutes.

The actual baling process takes place immediately under the floor level, which necessitated digging a pit 16 ft deep to house the huge hydraulic cylinders, heavy pressure rams and under-structure of the machine.

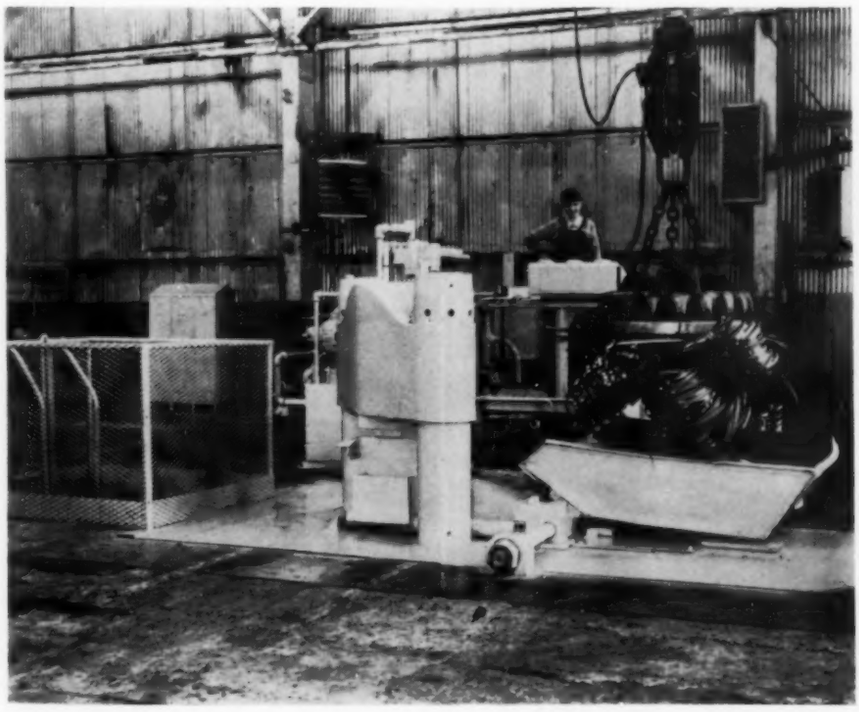
Scrap from Wheeling Steel's fabricating plants in the Ohio Valley is delivered to Beech Bottom by trucks, baled and then sent to the open hearth furnaces at Wheeling's Steubenville, Ohio, works.

In addition to speeding up delivery of much needed scrap with a minimum of material loss, the new scrap baling process helps to increase steel production in other ways, according to Wheeling Steel officials. Scrap in a denser form is easier to handle, requires less storage space, and makes the most efficient use of the charging boxes at the open hearth furnace.

It is estimated that time required for one "heat" can be reduced considerably through the use of these super-dense scrap bales.

The first installation of its kind, the equipment was built by Hydraulic Press Manufacturing Co. of Mt. Gilead, Ohio, working continuously with Wheeling Steel engineers over a period of more than 1½ years.

Bales of scrap are produced by this new automatic baler with more uniformity in size and weight and of a much greater density than heretofore possible.



PITTSBURGH STEEL BUYS MAIN DRIVE MOTORS

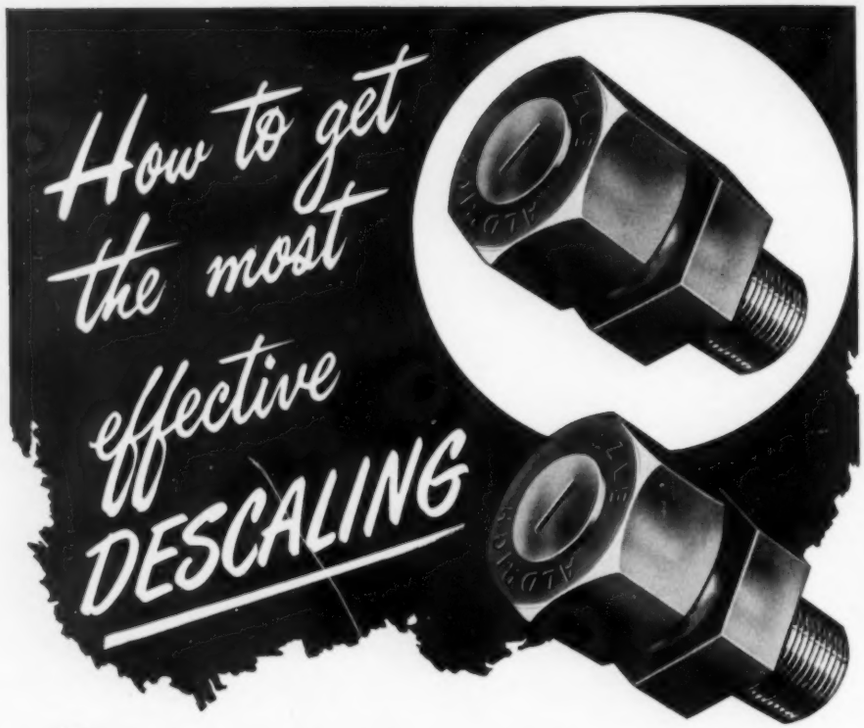
▲ Westinghouse Electric Corp. reported that it has been awarded an order of approximately $2,000,000 for the main roll and auxiliary drive electrical equipment for the Pittsburgh Steel Co.'s new 66-in. four-stand tandem cold strip mill at Allenport, Pa.

The order provides for two 1500 hp motors for stand No. 1 and six 2250 hp motors for stands 2, 3 and 4, as well as a 1200 hp double armature motor and magnetic brake for the take-up reel. Westinghouse engineers have pointed out that this marks the first time twin motor drives will be installed on all stands of a tandem cold strip mill.

Direct current power for these motors will be supplied by two motor-generator sets, each equipped with a 10,000 hp synchronous motor and generators capable of producing 7000 kw. Also included in the order will be all necessary variable voltage control equipment, including the newly-developed magnetic amplifier "Mag-amp" control.

The mill is designed to operate at a maximum delivery speed of 3100 fpm, and will produce sheet gage strip from .015 in. to .050 in. thick and from 24 to 62 in. wide. The strip will be in coils up to 72 in. in diameter and weighing 30 tons.

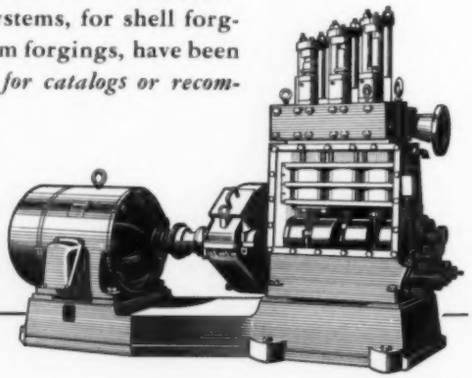
The Westinghouse electrical equipment for the mill is scheduled for delivery during early 1953, and the mill will begin regular operation during the summer of 1953.



Descaling is most effectively accomplished by means of the impinging force of a thin solid jet of water produced by high pressure. Scale is loosened in a fraction of a second by this force and by contraction due to cooling; it is then washed off by the deflected stream of water. The sharp, knife-edge of water and the solid striking force developed by *Aldrich Patented Spray Nozzles* give far more effective descaling than jets of equal force but with a larger impinging area, produced by more water at lower pressure—as proven in hot strip as well as billet descaling.

Several types of Aldrich Spray Nozzles are available from stock. *Write for Data Sheet 61-2.*

Aldrich Direct Flow Pumps used for descaling systems are fitted with automatic by-pass valves which operate with all types of accumulators. Both descaling cabinets and hydraulic systems, for shell forgings and other small to medium forgings, have been designed by Aldrich. *Write for catalogs or recommendations.*



THE ALDRICH PUMP COMPANY

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. . . Originators of the Direct Flow Pump

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WEIRTON STEEL ORDERS BLAST FURNACE CLEANERS

▲ Weirton Steel Co., Weirton, W. Va., ordered five Cottrell precipitators from Research Corp. for their new blast furnace which is a part of Weirton's expansion program.

Two of these precipitators will be used for cleaning the blast furnace gas for subsequent use in under-fired coke ovens. They will have a capacity of 30,000 cfm and a 98.7 per cent collection efficiency guarantee.

One of the units will clean the blast furnace gas for steam generating applications. It will handle 55,000 cfm and is guaranteed for 91 per cent collection efficiency.

The other two precipitators will clean gases for use in stoves and will handle 90,000 cfm at a 95 per cent collection guarantee.

TCI TESTS ORE BLENDS TO RAISE OUTPUT

▲ Tennessee Coal and Iron Division of the United States Steel Co. will soon begin receiving the first test shipments of what may eventually be a large tonnage of Lake Superior district iron ores for use in its blast furnaces.

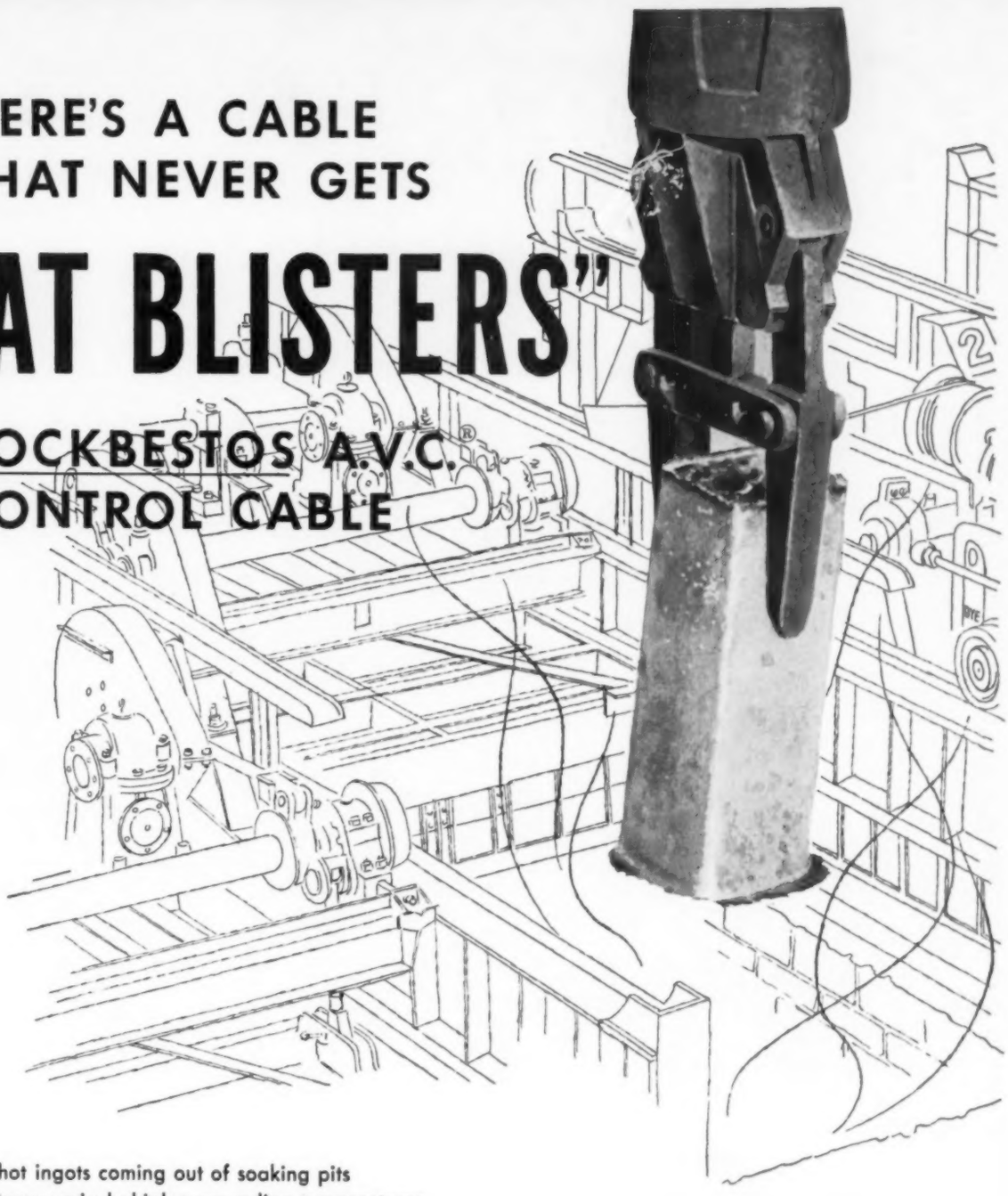
The Lake Superior ores, considerably richer in iron content than ores mined in the Birmingham, Ala., district, will be blended with local ore so as to raise the output of TCI's blast furnaces. The northern ore will be purchased from the Oliver Iron Mining Division of U. S. Steel and will be shipped by rail to Birmingham.

The TCI division has frequently in past years found it desirable to bring outside ores into Birmingham, from both domestic and foreign sources while iron ore exists in the Birmingham district in great abundance, and geologists have predicted that reserves will last far beyond the lifetime of anyone living today, the local ores contain only about 37 per cent iron at best. The ores to be shipped in run to around 57 per cent iron. Thus, local ores can be enriched through the blending processes in central ore conditioning plant and get more iron from our blast furnaces.

Following test work with the original shipments of Lake Superior ore, TCI will determine which grade is best suited for use in its blast fur-

HERE'S A CABLE THAT NEVER GETS "HEAT BLISTERS"

ROCKBESTOS A.V.C. CONTROL CABLE



Red hot ingots coming out of soaking pits create excessively high surrounding temperatures . . . temperatures that can ruin ordinary cable insulation —yet Rockbestos A.V.C. soaking pit and crane wiring cables take this punishment in steel mills day in, day out without cracking, blistering or deteriorating.

If you have a problem where heat, steam or corrosive fumes are a problem, it will pay you to use Rockbestos A.V.C. power and control cables. Not only will they keep your production going but they will cut maintenance costs "down to the bone."

ROCKBESTOS A.V.C. SOAKING PIT CABLE

ROCKBESTOS PRODUCTS CORP.

NEW HAVEN 4, CONN.

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • OAKLAND, CALIFORNIA • NEW ORLEANS • SEATTLE

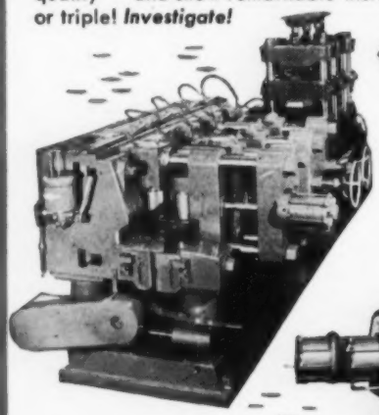
Hi ...*Your best buy*

Boost Cold Finished Bar & Tube Output!

with MEDART

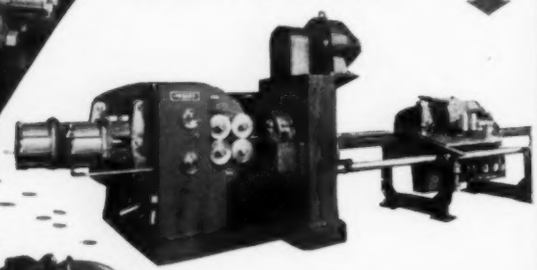
COLD FINISHING MACHINES

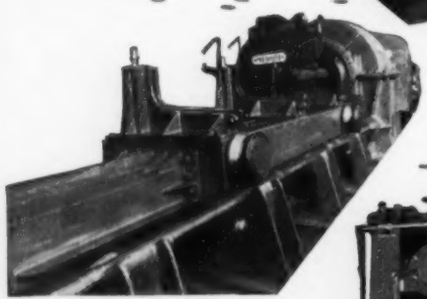
Medart Equipment can fulfill today's urgent demand for ***more and faster production!*** Used in virtually every steel and non-ferrous mill in the country, Medart Machines have ***proved*** they can keep costs down — give closer control over quality — and show remarkable increases in output, in some cases almost double or triple! ***Investigate!***



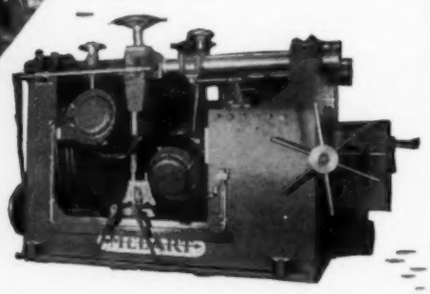
SHAPE STRAIGHTENER — Model TPVC
For large production at extremely high speeds. Handles squares, flats, octagons, hexagons in 2 planes without roll changes.

CENTERLESS BAR TURNER
Doubles grinding department production. Patented "torque-chipping" feature and push-draw feed turns bars small as ¼" at very high speeds.





BILLET PEELERS
A complete line handles ferrous or non-ferrous billets 1" to 14" in diameter at up to 40 ft. per minute.



STRAIGHTENING, SIZING, POLISHING MACHINES
Equipment to meet every need for precision top-speed production on round bars, tubing and pipe. "Medart Finish" has become the standard of the industry.

Write FOR CATALOGS
Straightening, Turning, Polishing, Sizing Machines—Bar And Billet Peelers—Centering Machines—Tube Derodders—Bar Pointing Machines, etc.

THE MEDART COMPANY 3535 DE KALB STREET ST. LOUIS 18, MISSOURI

naces. Thereafter, it is planned to bring in 100,000 tons of the selected grade for further experimental use.

REFRACTORY INDUSTRY MUST CONTINUE EXPANSION

▲ Floyd L. Greene, president, General Refractories Co., said recently that the refractories industry must continue to expand to keep pace with our nation's industrial needs because of the unprecedented demand for higher and higher steel production caused by the "world's continued unrest."

In a statement on general business conditions in the industry Mr. Greene said that the industry would be able to meet the announced needs of the steel industry as soon as new refractories plants throughout the country are in production. Steel has reported that it will be producing 118,000,000 tons by the end of 1952.

General Refractories expansion program was started in 1949. The program which is expected to be completed in 1952 will cost an estimated $13,500,000. Many of the company's 23 plants are being modernized and others are being expanded. New plants are under construction in Warren, Ohio; Los Angeles, Calif., and in Morrisville, Pa., near the new Fairless Works of the U. S. Steel Co.

"Expansion throughout the refractories field, similar to ours, will assure industry of increased supplies of temperature resisting brick," Mr. Greene said. Although iron and steel take about 70 per cent of the industry's annual output for its coke ovens, open hearth and blast furnaces, the nonferrous metals, rock products industries, glass, paper and pulp, and power industries are also important markets. He said that he expected all presently contemplated refractories plants to be in operation by the end of 1952.

BLISS ANNOUNCES MANY FOREIGN SHIPMENTS

▲ Evidence of the nation's ability to supply substantial capital equipment abroad while filling a higher-than-ever volume of domestic orders comes from E. W. Bliss Co.'s rolling mill division at Salem, Ohio. Officials report shipments from Bliss factories alone, to steel, aluminum and brass

"Tycol Apreslube cuts bearing failure... keeps production going at top speed"

That's correct! Tycol Apreslubes are extreme pressure lubricants that stand up under severe heat and moisture conditions, under tremendous loads. They inhibit rusting, and are highly stable.

Tycol Apreslube means lower lubrication costs . . . longer equipment service life . . . and positive protection against excessive gear and bearing wear.

For complete data, call or wire your nearest Tide Water Associated office.

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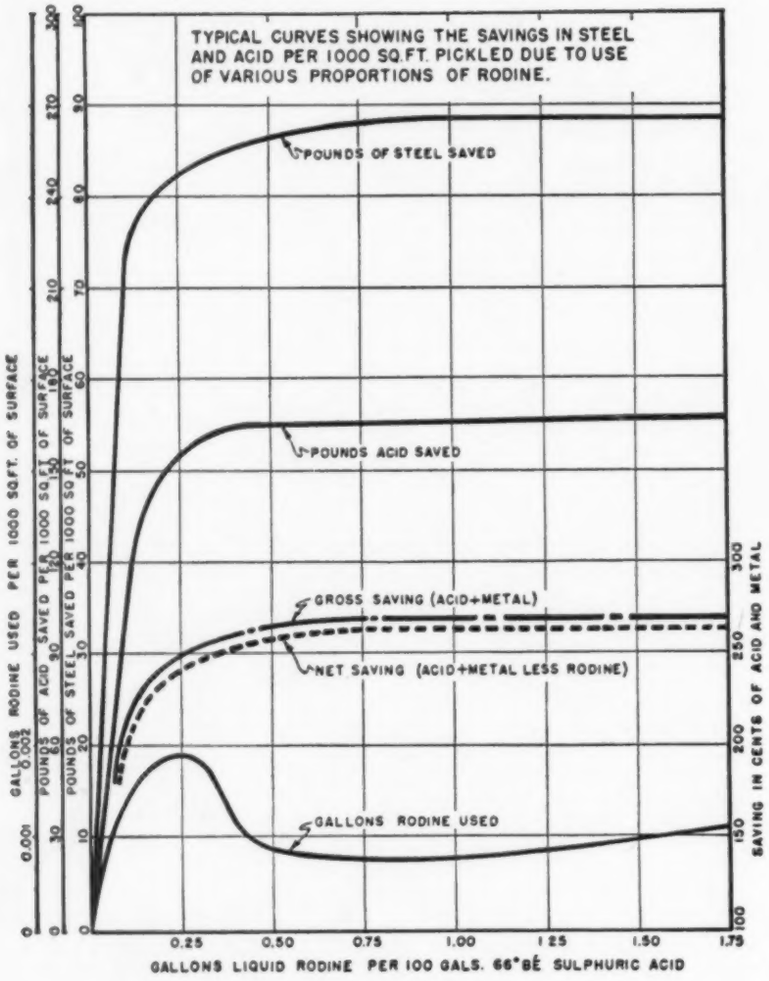
AMERICAN CHEMICAL PAINT COMPANY

AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet

Subject: EFFICIENT PICKLING WITH "RODINE"®

A. SAVINGS POSSIBLE WITH "RODINE"


TYPICAL CURVES SHOWING THE SAVINGS IN STEEL AND ACID PER 1000 SQ.FT. PICKLED DUE TO USE OF VARIOUS PROPORTIONS OF RODINE.
POUNDS OF STEEL SAVED
POUNDS ACID SAVED
GROSS SAVING (ACID+METAL)
NET SAVING (ACID+METAL LESS RODINE)
GALLONS RODINE USED
GALLONS RODINE USED PER 1000 SQ.FT. OF SURFACE
POUNDS OF ACID SAVED PER 1000 SQ.FT. OF SURFACE
POUNDS OF STEEL SAVED PER 1000 SQ.FT. OF SURFACE
SAVING IN CENTS OF ACID AND METAL
0.25
0.50
0.75
1.00
1.25
1.50
1.75
GALLONS LIQUID RODINE PER 100 GALS. 66°BÉ SULPHURIC ACID

B. TYPICAL APPLICATION OF "RODINE"

Pickling shell cases in uninhibited muriatic or sulfuric acid contributes to their embrittlement and makes it difficult to draw them without breakage. By adding a small amount of "Rodine" to the pickle bath, embrittlement is suppressed and more than enough acid is saved to pay the costs of the inhibitor.

CHEMICALS ACP PROCESSES WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM. CHEMICALS ACP PROCESSES

mills in Europe, South America and Asia have mounted to $7,500,000 during the past four years.

Italy received no less than twelve complete installations from E. W. Bliss Co., most of which were financed through ECA funds. Acciaierie e Ferriere Lombarde Falck, one of Italy's major producers, purchased the most modern rewind and welding lines available in America in addition to various modern four-high and special design cold reducing mills.

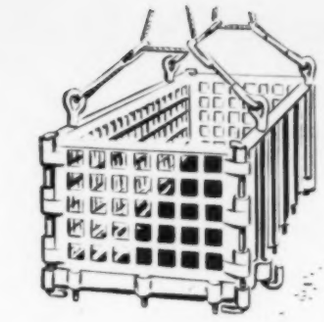
Sandvik Steel Works, Inc., Sandviken, Sweden, installed a Bliss mandrel type hot coiler, claimed to be the most efficient found in American steel plants. It is a special design unit used for coiling strip "on the fly," off the hot mill, and such units have been built up to 96 in. wide, for handling coils weighing up to 30,000 lbs. Sandvik also during 1950 put into operation a Bliss-built four-stand tandem cold mill for rolling special grades of stainless and razor blade stock.

In Mexico, Bliss engineers supplied the country's first four-high mill which is used to roll aluminum. This original four-high mill for Mexico incorporates several features which especially adapt it to certain native conditions which exacted recognition. Recently placed in operation by inexperienced natives, the mill has presented no difficulty in service or maintenance. Mill versatility permits heavy and light-gage rolling.

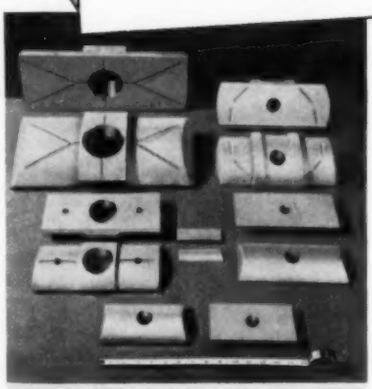
England, France, Switzerland, Belgium, British West Indies, Japan and Peru also received metal processing equipment from the Bliss Salem plan company officials stated. At the same time, shipments to American steel, brass and aluminum mills have increased over 50 per cent in dollar volume since 1947. Order backlogs show a 75-25 per cent domestic-to-export ratio, which is considered normal.

The company was recently awarded the $500,000 contract by Volta Redonda, Brazil plant of Companhia Siderurgica Nacional (National Steel Co. of Brazil) to design and manufacture hot strip mill auxiliary equipment.

At present, Bliss is manufacturing for delivery in July 1952 a reversing hot strip mill and auxiliaries for Forges d' Hennebont in France. Covered by separate contracts totaling approximately $800,000 is the modernizing of a combination cold reduction and temper pass mill, supplying



Pickling Costs Dip...



CAST-TO-SIZE SLIPPERS

Protect your production schedules with wear-resistant Ampco Metal "cast-to-size" slippers. Furnished to $+\frac{1}{32}$" -0", or $-\frac{1}{32}$" $+0$" tolerances with oil-grooves cast-in to requirements. Accurate surface finishes eliminate necessity of machining.

when you use corrosion resistant

AMPCO* METAL

- **to reduce replacement costs**
- **to cut down-time losses**

Ampco Metal crates, baskets, yokes, chains and other pickling equipment meet the "acid-test" with their outstanding resistance to corrosion from sulphuric acid pickling solutions.

Put them to work for you and watch your costs dip and your profits rise. They stay on the job longer, save hours of downtime and hold maintenance, repairs, and replacement to a minimum.

See your nearby Ampco field engineer for complete details about the Ampco alloy that meets your needs best — for pickling equipment and many other steel mill applications where tough, wear-resistant Ampco Metal can save you money.

*Reg. U. S. Pat. Off., Ampco Metal, Inc., Milwaukee, Wis.

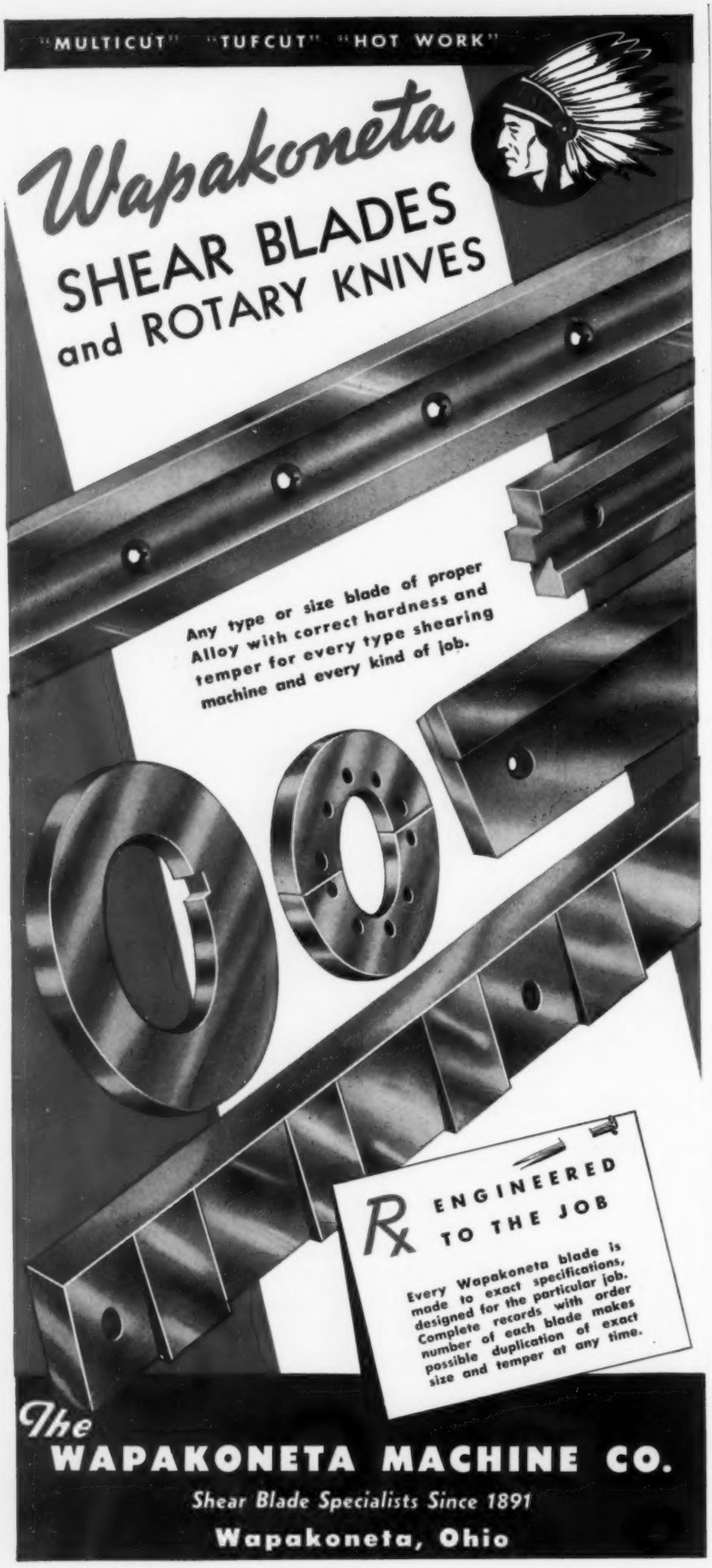
a-6

AMPCO®

Ampco Metal, Inc.

1710 SOUTH 38TH STREET • MILWAUKEE 46, WIS.

West Coast Plant: Burbank, California


"MULTICUT" "TUFCUT" "HOT WORK"
Wapakoneta
SHEAR BLADES
and ROTARY KNIVES
Any type or size blade of proper Alloy with correct hardness and temper for every type shearing machine and every kind of job.
TOOL
Rx ENGINEERED TO THE JOB
Every Wapakoneta blade is made to exact specifications, designed for the particular job. Complete records with order number of each blade makes possible duplication of exact size and temper at any time.
The WAPAKONETA MACHINE CO.
Shear Blade Specialists Since 1891
Wapakoneta, Ohio

additional cold mill auxiliaries. In connection with this French project, certain parts are being manufactured in Bliss' French plant per the Salem, Ohio Rolling Mill Division shop drawings.

E. W. Bliss Co., which also has foreign plants in England and France, operates four other American plants in the manufacture of stamping presses and special machinery, and is recognized as the world's largest press builder.

FURNACE GROUP GIVES AWARDS TO FOUR MEN

▲ Four awards for outstanding contributions in the field of industrial heating were presented to three executives and an educator at the midwinter meeting of the Industrial Furnace Manufacturers Association, January 21, 1952 at Hotel Schenley, Pittsburgh, Pa.

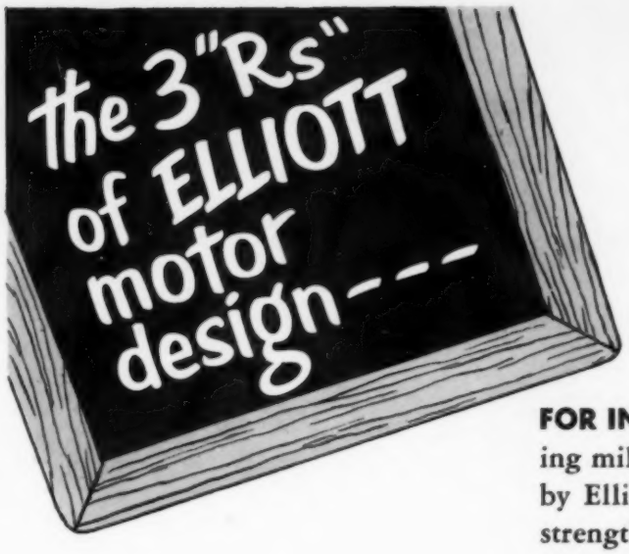
The awards were made to Dr. Guilliam H. Clamer, president of the Ajax Group Companies, Philadelphia, Pa.; William A. Darrah, president of the Continental Industrial Engineers, Inc., Chicago, Ill.; Adolph W. Machlet, chairman of the board, American Gas Furnace Co., Elizabeth, N. J.; and Frederick H. Norton, professor of ceramics, Massachusetts Institute of Technology, Cambridge, Mass.

The award, known as the Trinks Industrial Heating Award, was established in honor of Dr. Willibald Trinks, professor emeritus of mechanical engineering at Carnegie Institute of Technology.

Award committee judges included Professor Trinks; T. J. Ess, managing director of Association of Iron and Steel Engineers and editor of "Iron and Steel Engineer"; Stewart Clarkson, managing director of Industrial Furnace Manufacturers Association; Dr. J. C. Warner, president of Carnegie Institute of Technology; and James J. Nance, president of Hotpoint, Inc.

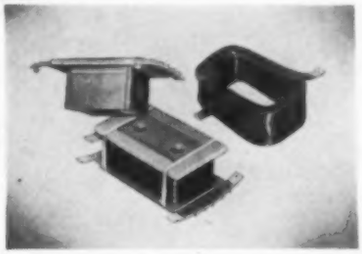
WESTINGHOUSE SUPPLIES EQUIPMENT FOR PRR

▲ Westinghouse Electric Corp. will supply approximately $350,000 worth of electrical equipment for two ore unloading towers being built by the Industrial Brown Hoist Co. for installation at the Pennsylvania Railroad's new pier at South Philadelphia, Pa.



RUGGED REFINED and RELIABLE

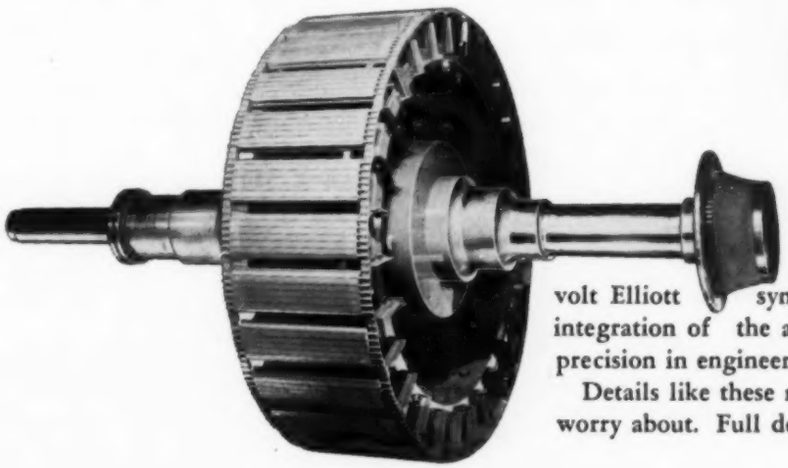
FOR INSTANCE—take a big synchronous motor for piercing mill drive service. Fundamental ruggedness is assured by Elliott "Fabri-Steel" construction with its crack-proof strength, extreme stiffness, and design flexibility. From there on individual details "carry the ball." Here are some of the more important features:



FIELD COILS are edge-wound copper strap, formed, annealed, flattened, dipped and baked with several coats of insulating varnish. Riveted extensions of the pole head support the coil.

STARTING WINDING BARS are of sectional form and material adapted to starting torque required, are inserted into slots in pole faces, and silver alloy brazed to heavy, flat end ring segments for low resistance and an enduring joint.

FIELD LEADS in larger motors are of heavy strap copper, held by insulated studs. Note the heads of the heavy bolts which are threaded through a solid bar in the field coil, tightened with a torque wrench, and finally tack-welded.



TYPICAL ROTOR for a 5000-hp, 257-rpm, 13,800 volt Elliott synchronous motor illustrates the integration of the above features plus painstaking precision in engineering and workmanship.

Details like these make motors you don't have to worry about. Full details in Bulletin P-B-5000.

ELLIOTT Company

DEPT. 15

Ridgway Division

RIDGWAY, PA.

R2-3

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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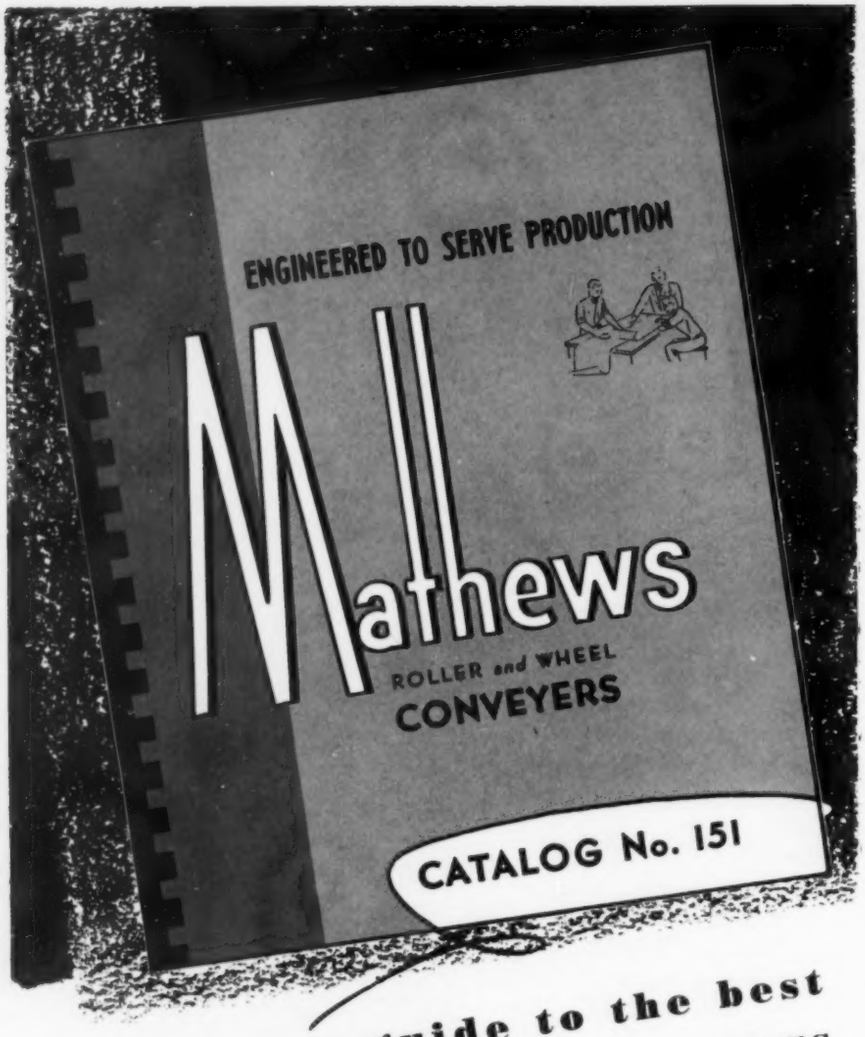

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● 68 pages of design details and illustrations covering MATHEWS Roller and Wheel Conveyers. A complete line of high-quality rollers ranging in diameter from 1" to 6½", and in capacities from 50 to 16,000 pounds, is shown in convenient sequence. Wheel Conveyers are described and illustrated. Whether you handle loads weighing a few ounces or 50,000 pounds, you will see that MATHEWS builds conveyers light enough or heavy enough to do the job efficiently. Write for Catalog 151 today. And remember, you get the best when you buy MATHEWS Conveyers.

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Engineering Offices or Sales Agencies in Principal American and Canadian Cities

These unloading towers will be used for unloading import ore for transshipment by rail. Each tower will be capable of handling 1200 long tons per hour of 150-lb-per-cu ft ore on a 45- to 50-second duty cycle. Two aprons will permit unloading from either side of the pier.

The bucket and trolley drives will be operated from an adjustable-voltage system, with power supplied by a 5-unit motor-generator set. This includes two 250-kw generators, one 300-kw generator, one 125-kw generator, and a 700-hp synchronous motor. The drives are equipped with mill-type d-c motors. Constant potential a-c drives are used for the turntable apron hoists, and tower travel. Power will be supplied to the towers at 4160 volts a-c.

DELTA-STAR EXPANDS CHICAGO, ILL., PLANT

▲ Plans have been drawn and contracts signed for a $500,000 plant expansion program at Delta-Star Electric Co., division of H. K. Porter Co., Inc., Chicago, Ill.

The new plant expansion comprises the construction of extensions on both the north and south ends of the main factory. These new facilities will provide 30,000 sq ft of additional assembly and machine shop space, greatly expanding the company's manufacturing facilities. The plans call for the expansion to be completed by August, 1952.

The engineering contract for design and drawing has been awarded to Giffels & Vallet, Inc., Detroit, Mich. Hansell-Elcock Co., Chicago, Ill., has been given the structural steel fabrication and erection contract.

CANADIAN FIRM TO BUY SLAB HEATING FURNACE

▲ A new continuous slab heating furnace to be built for Steel Co. of Canada, Ltd., will increase the productive capacity of rolled strip at its Hamilton, Ontario works by approximately 100 per cent, according to the designer-constructor, the Rust Furnace Co., in combination with Rust Engineering Co. of Canada, Ltd.

The furnace, with a rated capacity of 110 tons per hour, will serve the hot strip mill and will be of the zone-controlled, triple-fired, recuperative type, capable of burning coke oven

- *Expert Help on All Engineering Problems*
- *Exacting Design and Drafting Service*
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YORK Engineering & Construction Company

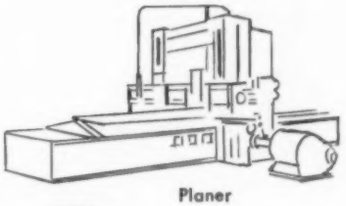
is Expanding

with purchase of the Gillespie Manufacturing Company,

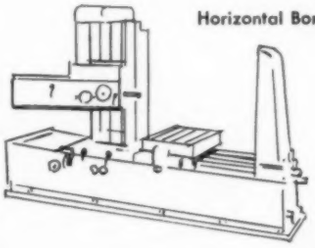
forming an affiliate:

YORK·GILLESPIE MANUFACTURING COMPANY

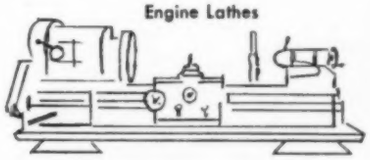
York's purchase of the Gillespie plant combines York's engineering and construction know-how with broad machine shop facilities capable of producing fine *custom-built* machinery and auxiliary equipment for steel mills and other industrial plants.



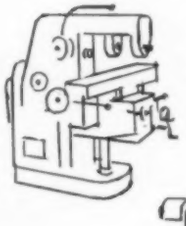
Planer



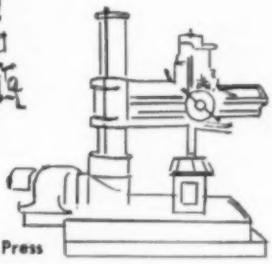
Horizontal Boring Mill



Engine Lathes



Milling Machine



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Illustrations showing some of our shop facilities.

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951 Penn Avenue, Pittsburgh 22, Pa.

gas, natural gas, or fuel oil. It will be equipped for full automatic control of temperature and furnace pressure with automatic fuel-air ratio.

The new facility will supplement two 60-ton per hour Rust furnaces previously installed at the Hamilton Works: one in 1940 when the strip mill was finished, and the second in 1945. Plans call for these furnaces to be rebuilt at a future time for the same capacity as the new furnace.

Rust Engineering Co. of Canada, Ltd., will also construct a new 225-ft reinforced concrete chimney to serve the coke ovens at the same works of this company. This is in addition to a new 250-ft chimney just recently completed by Rust, to serve the same ovens.

NICKEL FIRM COMPLETES CONCENTRATE PIPELINE

▲ A 7½-mi pipeline has been completed by International Nickel Co. of Canada, Ltd., through which the bulk concentrate from 3,650,000 tons of nickel-copper ore is being pumped annually from its newly-built Creighton concentrator to its reduction plants at Copper Cliff, Ontario, Canada. It is believed that never before has concentrate been carried by pipeline in such quantity over such a distance.

The pipeline reduces the time required to transform nickel ore into refined nickel. Further, the economies resulting from pipeline transportation, together with other economies, have made possible the working of lower-grade Creighton ore which is now contributing to the availability of nickel for defense production needs.

Part of International Nickel's $130,000,000 program of underground mine expansion, the pipeline artery has been integrated into an elaborate pipeline system which also carries tailing, or waste material, from both Creighton and Copper Cliff to a disposal area midway between the two plants.

The system has 12 miles of trestle, at some points 65 ft high to assure a slope to and from each of the five relay pumping stations so that the concentrate lines will be self-draining in case of power difficulties. All told, 3 million board ft of lumber and 40 mi of wooden pipe were used.

When milling 10,000 tons of nickel-copper ore a day at Creighton, approximately 1800 tons of concentrate and 8200 tons of tailing are produced. Water added to the concentrate makes a pulp which flows through the pipeline at the rate of 800 gpm. The tailing pulp flows at the rate of 2500 gpm.

Despite the rigorous northern winter weather, the complete pumping system has been designed for trouble-free operation. Several times the temperature has dropped to 30 degrees below zero with no operating difficulties.

KOPPERS TO CENTER RESEARCH AT VERONA, PA.

▲ Koppers Co., Inc., will embark on an enlarged and more unified program of research, with a major portion of such work centered at Verona, Pa., where new laboratories are now nearing completion.

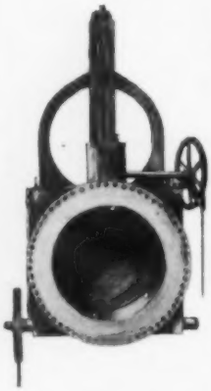
The company has purchased a plant site it formerly leased at Verona, re-arranged its buildings and added a new building, which will contain administrative offices, the company's research library and conference rooms.

Dr. G. F. D'Alelio, vice president and manager of Koppers research department, revealed some of the plans for the new research center.

"Within a few months, a major portion of our research will be cen-

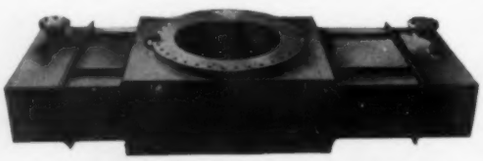
VERTICAL *or* HORIZONTAL GOGGLE VALVES

By KINNEY



VERTICAL OPERATION

- VERTICAL, HORIZONTAL, INCLINED
- OPEN OR TOTALLY ENCLOSED
- EMBODIES OWN EXPANSION JOINT
- REQUIRES NO SUPPORT FROM GROUND
- NOT AFFECTED BY TEMPERATURE CHANGES
- CLAMPING MECHANISM HAS POSITIVE MOVEMENT IN BOTH DIRECTIONS
- CORTEN DIAPHRAGM
- STAINLESS STEEL SEAL RING
- STRAIGHT LINE OPERATION
- GEAR REDUCTION ON PLATE DRIVE



HORIZONTAL OPERATION

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- 24" TO 108" IN DIAMETER
- NEARLY 100 IN OPERATION.

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Designed for 1½" armor plate, but successfully straightens 5" carbon steel

... *with help of TIMKEN® bearings*

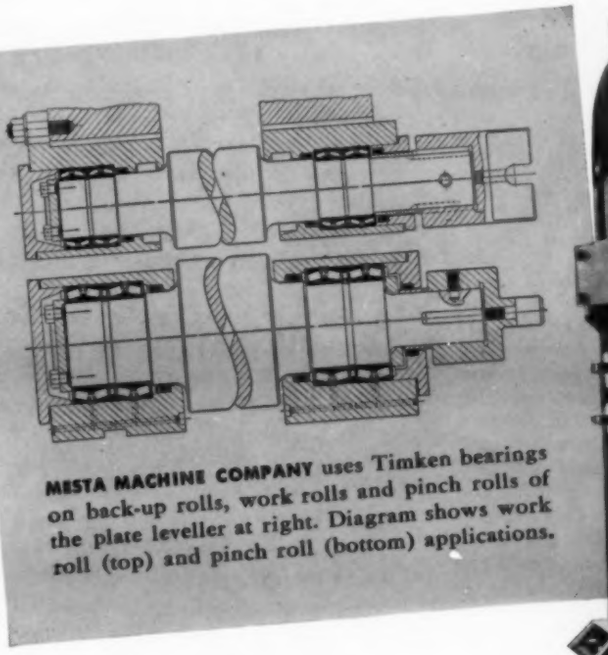
DESIGNED for 1½" armor plate, this giant 195-inch Mesta plate leveller has demonstrated its tremendous capacity by successfully straightening 5" carbon steel. One reason for this extra capacity: Timken® tapered roller bearings are used on the back-up rolls! These Timken bearings are 11" wide, with a 11.994" bore and 17.246" O.D. Each pair of back-up roll bearings take a separating force of 1,250,000 pounds. With 3 back-up rolls per work roll, the total separating force on six bearings is 3,750,000 pounds.

Because of line contact between Timken bearing rollers and races, there's load capacity to spare. And the rollers and races are case hardened to give a hard, wear-resistant surface combined with tough, shock-resistant cores.

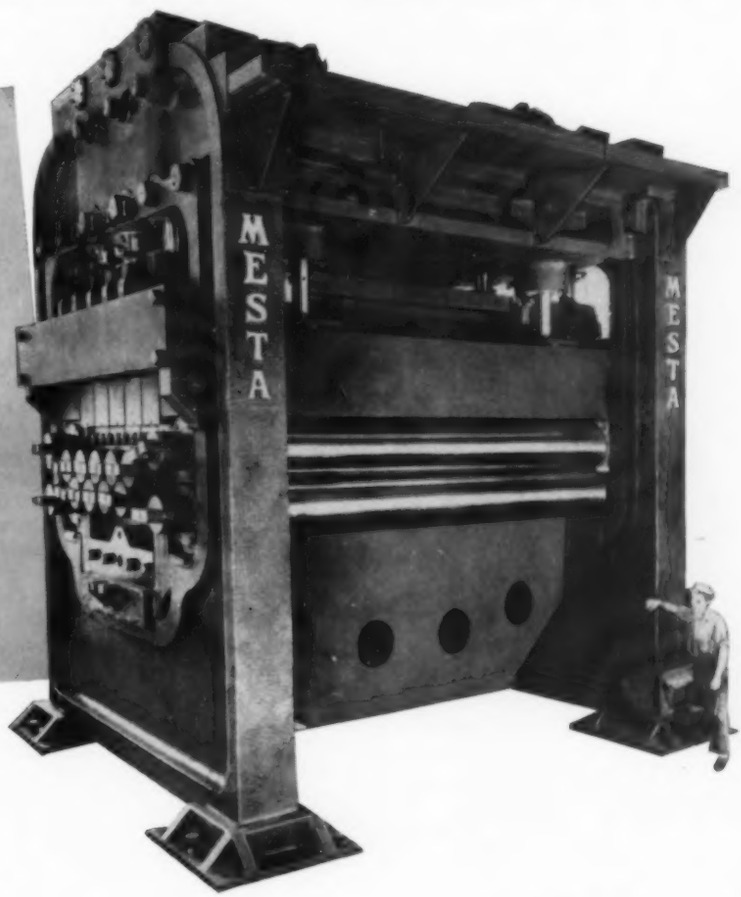
Timken bearings are made of Timken fine alloy steel—finest steel ever developed for tapered roller bearings. Their true rolling motion and incredibly smooth surface finish practically eliminate friction even under the heaviest loads.

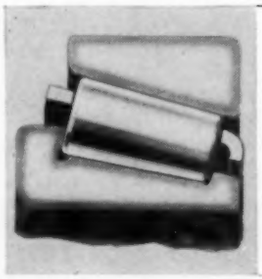
Timken bearings are now used on the back-up rolls of practically all makes of levellers. Make sure the bearings in the machine you build or buy are stamped with the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



MESTA MACHINE COMPANY uses Timken bearings on back-up rolls, work rolls and pinch rolls of the plate leveller at right. Diagram shows work roll (top) and pinch roll (bottom) applications.





GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳

tered at Verona," he said, "and by 1953 we may have nearly 200 chemists, physicists, engineers and technicians working there. Considerable new equipment is being installed in the laboratories and they will be modern in every way."

Dr. D'Alelio explained that the new Verona center not only will provide enlarged and improved laboratory facilities but is designed to allow extensive pilot plant work to be carried on. One large area will be devoted to pilot plant work in chemicals, another in fuels and a third in the testing and improving of large machinery which the company makes, such as electronic precipitators.

In these pilot plant areas, as many as ten miniature industrial plants may be in operation at the same time. One such plant, now planned, will make gasoline and oil from coal through the process known as hydrogenation, the Koppers research manager said. Koppers Engineering and Construction Division built a coal-to-oil demonstration plant at Louisiana, Mo., for the U. S. Bureau of Mines. While this plant gasefies coal and turns the gas into liquid fuels, the hydrogenation method uses powdered coal in a slurry as raw material. Gasoline with higher octane rating can be produced by the hydrogenation method.

Equipment of the experiment station which has been conducted by the research department, at Kearny, N. J., has been moved to Verona.

Dr. D'Alelio said that the new facilities will enable Koppers to probe more broadly in the fields of coal chemicals, plastics, resins, wood preserving, and metal products and also to determine new fields of endeavor which the company may enter in the future.

Dependable Operation under all conditions!

60" x 48" Bailey Valve for Horizontal Gas Main.

Bailey MECHANICAL GOGGLE VALVES

BAILEY Goggle Valves provide a tight, positive seal for shutting off gas mains in emergencies or for repairs. Requiring a minimum of maintenance, they operate by a powerful clamping force which is applied equally at all points around the disc periphery. Regardless of time between operations, they open or close instantly. Sizes from 6" to 72", totally enclosed if desired.

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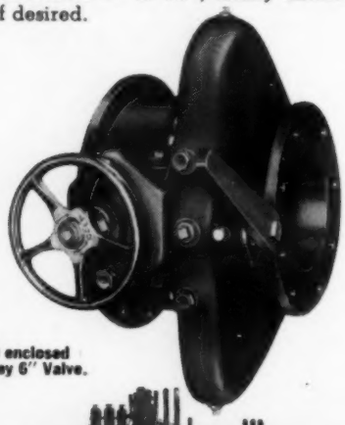


Totally enclosed type Bailey 6" Valve.

WILLIAM M. Bailey COMPANY
ENGINEERS
LEADERSHIP THROUGH QUALITY
1221 BANKSVILLE ROAD PITTSBURGH 16, PA.

"LIGHT STEEL" PROCESS HOLDS HIGH INTEREST

▲ Interest in "light steel," a product of a direct reduction process discovered at the Ontario (Canada) Research Foundation, is running high. Some 70 companies have already investigated the process, and at least six companies are seeking licenses for the process.

In this process, ground ore is poured into a paper tube or some other type of porous mold. The tubes full of iron ore are placed in a metal or ceramic sagger, which is then filled with a mixture of coke breeze and limestone, sealed, heated to 2000 F and held for a certain length of time. After cooling to about 100 F, the metal is removed from the saggers and may be reheated and hot worked by swaging.

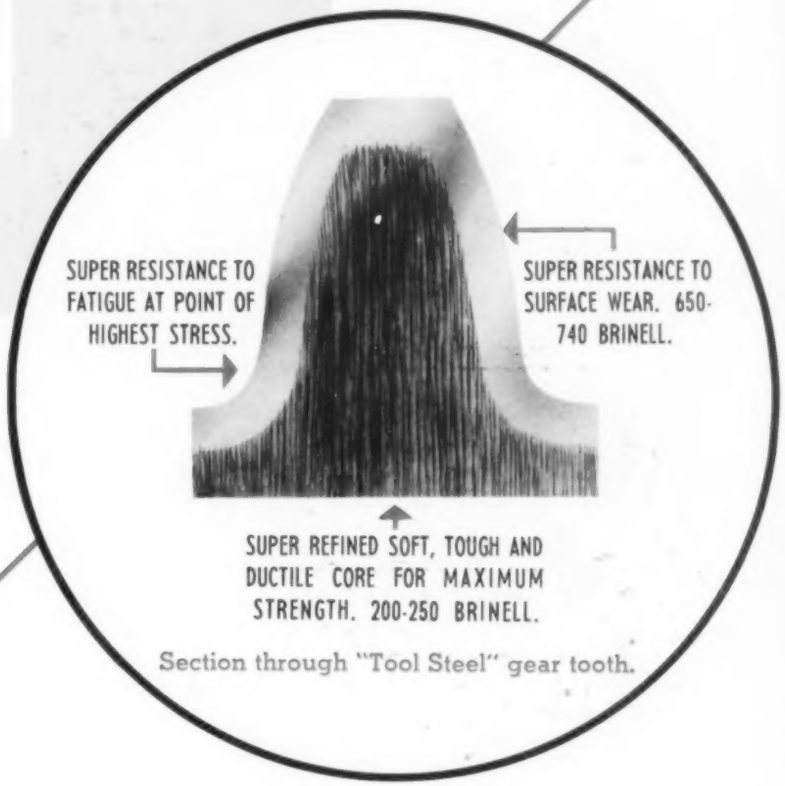
Carbon content and density of the product may be varied by the characteristics and size of the ore, and by the time of soaking. Carbon content of the product may range from .01–1.5 per cent, and alloying additions may be mixed with the ore. Density can be controlled to range 13–90 per cent of the density of ordinary steel. Tensile strength is in direct relation with density, running 15,000–20,000 psi at densities of 2.5–4.0.

The first hot working must be very gentle, but once a density of 7.5 or more is obtained, hot working may proceed in the same way as with ordinary steel. Annealing, hardening, etc. may be carried on as with ordinary steel.

The process is directly competitive with powder metallurgy, but is not expected to compete with regular steel producing methods. It has, however, interesting possibilities for special conditions.

TSP super resistance to wear and fatigue

guaranteed longer gear life


SUPER RESISTANCE TO FATIGUE AT POINT OF HIGHEST STRESS.
SUPER RESISTANCE TO SURFACE WEAR. 650-740 BRINELL.
SUPER REFINED SOFT, TOUGH AND DUCTILE CORE FOR MAXIMUM STRENGTH. 200-250 BRINELL.

Section through "Tool Steel" gear tooth.

TOOL STEEL PROCESS

"TSP" means "Tool Steel" Process ... the name that carries an absolutely positive guarantee for longer, more economical and satisfactory service on gears, pinions and other hardened products.

You get tremendous savings in operating and maintenance costs with "Tool Steel" gears and pinions! Each "Tool Steel" gear and pinion carries a written guarantee to provide greater service life than any other gear and pinion used in the same service. Your own records are used for comparisons.

"TSP" hardened gears and pinions contain all the qualities of any other hardening plus the super resistance to wear and fatigue that only "Tool Steel" can give you.

"Tool Steel" gears and pinions are made in all sizes to 80" pitch diameter and in pitches from the heaviest to 10 D.P. Special designs, applications, and quantities can be engineered to your requirements.

If you're planning a gear or pinion replacement, get the best ... get "Tool Steel" and be protected.

THE TOOL STEEL GEAR AND PINION COMPANY

CINCINNATI 16, OHIO • U. S. A.

WEIRTON'S DETINNING UNIT CONSERVES TIN

▲ A new "first" in steel industry history has been scored by the Weirton Steel Co. division of National Steel Corp. through the start of operations, announced recently, of its newly-constructed detinning plant, the only one of its kind in the United States which is owned and operated by a steel company.

The detinning facilities were installed, according to Weirton officials, in order to conserve every possible ounce of scarce and vital tin and also to provide additional steel scrap which is now in critically short supply.

The detinning plant is housed in a main building 465 ft long and 70 ft wide and several servicing lean-to buildings, all of which were recently erected on a site adjacent to the company's 10-in. and 16-in. strip steel plant. The detinning facilities consist of detinning, rinse and precipitation tanks, filters, furnaces, a scrap bundling press and auxiliary equipment.

The plant will have a capacity for the recovery of 300,000 lb of tin and 30,000 tons of high quality steel scrap per year. The large-scale recovery of tin in the new plant will be supplemented by the salvage of the scarce metal from chemical solutions used in the production of tin plate by the electrolytic process. Facilities for the latter purpose were installed in 1942 and have made possible a substantial saving of tin.

The "raw material" for the detinning plant consists mainly of scrap produced in the manufacturing operations of Weirton Steel Co.'s tin mills. The company is the world's largest independent producer of tin plate, and its tin mill at Weirton, W. Va., is the largest under one roof. Some tin plate scrap also will be purchased from the outside. At the tin mills, the strips and pieces of scrap are wound into large bales for shipment to the detinning plant.

The first step in detinning is to cut the bales open with a large electrically-driven friction saw. The loosened scrap is then picked up by magnet crane and dumped into a hopper from which it is discharged into cylindrical drums that are 8 ft in diameter and 11 ft long. The average charge is from 5400 to 6000 lb of scrap.

The drum is closed, picked up by crane, and placed in one of five detinning tanks which contains a bath of caustic solution.

The sodium-tin compound is pumped from the detinning tanks in the form of a "slurry" and is processed through an intricate maze of precipitation tanks and filters which convert it into a tin oxide having the color and consistency of putty. This material is dried in a gas-fired furnace and then charged into an electric reduction furnace, together with fine anthracite coal. The carbon in the coal unites with the oxygen in the tin oxide, thus forming gases which are driven off and freeing the pure tin. The molten tin is tapped from the furnace periodically and cast into 100-lb "pigs" which are shipped to the tin mills to start again in the cycle of tin plate production.

The recovery of tin from the chemical solution at the tin mill is the same on a smaller scale as the process used to extract tin from the "slurry" in the detinning plant.

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STANDARD CARBON PRODUCTS

No truer measurement of quality can be had than observing a "Standard" brush operating on equipment in the largest mills in the world and some of the largest coal mines.

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BRUSHES for Rotary Converters • Synchronous Motors • Mill and Crane Motors • Mining Machinery Motors • Large Rolling Mill Equipment • Plating Generators • Everything in the fractional line.

MOLDED PRODUCTS
ELECTRODES Up to 6″ Diameter and 40″ Long

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Whether you want to improve your Roadway, Parking Lot or Trackage Lighting — or utilize Searchlights or Fresnel Floods for fence or boundary protection — or improve the lighting of your Craneways, fixed work positions, inspection departments, etc., Revere offers specific units to do an efficient job.
Our engineering department will gladly collaborate with yours in achieving desired results.
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LOWERING HANGER eliminates risky climbing
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REVERE ELECTRIC MFG. CO.
6036 Broadway • Chicago 40, Ill.
INDOOR & OUTDOOR LIGHTING FOR EVERY NEED

DE LAVAL FORMS NEW WEST COAST SUBSIDIARY

▲ De Laval Steam Turbine Co., Trenton, N. J., has announced the formation of a subsidiary corporation, the De Laval Turbine Pacific Co. Headquarters for the company will be at Main and Folsom Streets, San Francisco, Calif. Company officers are: G. W. Smith, Jr., chairman; J. P. Stewart, president; and, C. F. Reeves, vice president and general manager.

Mr. Reeves will be in direct charge of operations of the company, continuing the duties he has held for many years as west coast manager of De Laval Steam Turbine Co. Branch sales offices are located in Los Angeles, Calif., under H. H. Reynolds, district manager, and in Seattle, Wash., under J. A. Greenland, district manager.

REPUBLIC AND ARMCO BUY ORE INTERESTS

▲ Republic Steel Corp. and Armco Steel Corp., have jointly acquired the 15 per cent interest in Reserve Mining Co. formerly held by National Steel Corp. This sale gives Republic and Armco each a 50 per cent ownership of Reserve.

Because of expansion in their blast furnace capacity, Armco and Republic are interested in immediate development of Reserve's plant in Minnesota to produce 2,500,000 tons of high grade iron ore per year from taconite. National Steel, on the other hand, with large iron ore reserves immediately available, felt it would not require ore from this new source for some years and was willing to transfer its interest in Reserve to Republic and Armco.

Reserve Mining has started construction of the main plant at Beaver Bay, Minn., which will be producing high grade iron ore pellets in 1955. Blast furnace tests using these pellets have been very favorable and they will play an important part in meeting future ore requirements for Armco and Republic.

A smaller taconite processing plant is now being built by Reserve at Babbitt, Minn., and will go into operation early this year. The iron ore will be produced in the form of hard, walnut-sized pellets and will be of much higher grade than any ores now being mined in the Lake Superior region.

STEELMAKERS REDUCE NICKEL STEEL OUTPUT

▲ Steelmakers have sharply reduced the output of alloy steel containing large amounts of nickel and molybdenum, American Iron and Steel Institute said recently. At the same time the steelmakers are seeking to broaden the use of boron steels in order to conserve dwindling supplies of the more versatile alloying elements such as nickel, molybdenum and chromium.

The output of four grades of alloy steels — the nickel, molybdenum-nickel-chromium and nickel-molybdenum grades—declined 22 to 64 per cent in the first ten months of this year, from the comparable part of 1950. Meanwhile, the output of all alloy steel ingots totaled 7,095,518 tons, an increase of 21 per cent.

NOW! SKYLIGHT WITH RESOLITE

Resolite is shatterproof. It can be worked, sawed, drilled with ordinary tools, and its installation ease is economical of man-hours.

TRANSLUCENT STRUCTURAL PANELS

Resolite makes large skylight and wallight areas economical for corrugated industrial buildings because no special framing is required, either for support or weatherproofing — it nests with any standard corrugated sheet. Resolite permits substantial savings in plant lighting by its efficient diffusion of daylight through the building interior.

Structurally rugged, chemically immune to weather extremes, and most industrial fumes, Resolite gives long life without protective treatment. Resolite is molded in standard sheet sizes and corrugations, made of polyester resins, reinforced with fiberglas mat — a quality product with controlled uniformity of thickness for strength and durability.

SPECIAL ARCHITECTURAL USES, TOO!

Interior and exterior decorative beauty is easy to obtain with Resolite's wide variety of colors and corrugated patterns. Store fronts, marquees, bar facings and patio covering are simplified in structure and assembly. While transmitting light freely, Resolite is impervious to vision, making it ideal partitioning for offices, shower stalls and toilet compartments.

Write for free literature

RESOLITE CORPORATION

ZELIENOPLE, PA.

At the same time, a sharp rise was made in the output of grades of alloy steel using smaller quantities of those elements. The output of nickel-chromium-molybdenum steel was over 1,800,000 tons, an increase of 86 per cent in the ten months. The production of this type of steel was aided by the greater recovery of alloying elements from scrap, and served as a conservation measure through the lesser use of added elements.

The development of boron steels will have to be pushed rapidly further to conserve shrinking supplies of the more versatile alloying elements, such as nickel, chromium and molybdenum, said one metallurgical engineer recently.

SHARON SUBSIDIARIES BECOME DIVISIONS

▲ Sharon Steel Corp. has announced the liquidation into the parent company of its subsidiaries, Niles Rolling Mill Co., Niles, Ohio; Brainard Steel Co., Warren, Ohio; and its warehouses — the Sharonsteel Products Co. (Mich.) and the Sharonsteel Products Co. (Pa.).

The change is being made to simplify the corporate structure of the company, and will involve no changes in personnel or management policies. In the future each of the subsidiaries involved will operate as divisions of the parent company. They will be known as Niles Rolling Mill Division, Brainard Steel Division, Sharonsteel Products Division (Dearborn), and Sharonsteel Products Division (Farrell).

GREENSBURG FIRM BECOMES I-T-E DIVISION

▲ Railway and Industrial Engineering Co., wholly owned subsidiary of I-T-E Circuit Breaker Co., ceased doing business on December 31, 1951 as a separate company. All of its assets and business, subject to all of its obligations and liabilities, were acquired by I-T-E.

Henceforth it will be known as the R&IE Equipment Division of I-T-E Circuit Breaker Co., and will continue all of its present operations in Greensburg, Pa. This change will not in any way affect the fulfillment of the contractual obligations made by Railway with its customers, suppliers, or employees.

K. S. Nevin has been elected a vice president of I-T-E Circuit Breaker Co. and manager of the new division. W. M. McCauley and G. L. Carlisle have been elected the vice president and commercial vice president, respectively, of I-T-E Circuit Breaker Co.

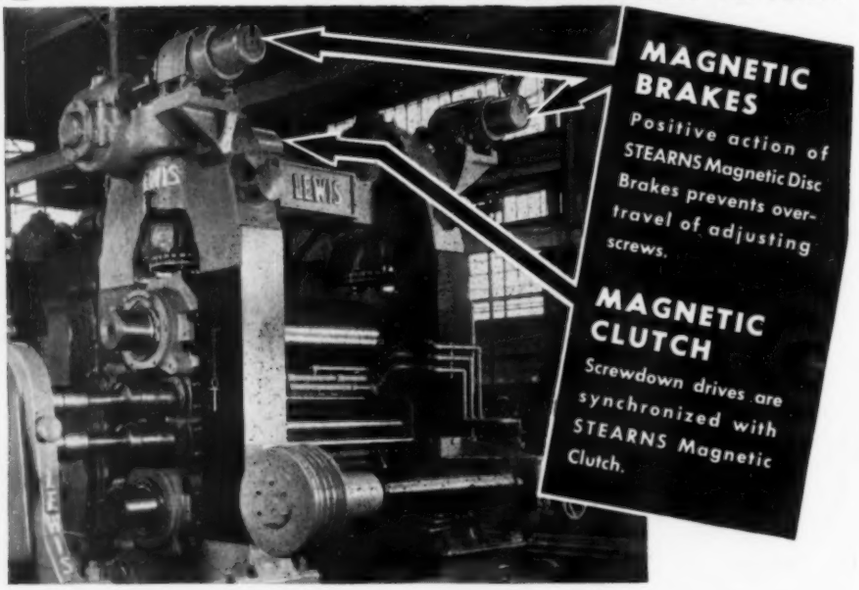
GEOGRAPHICAL CENTER OF STEEL INDUSTRY MOVES

▲ Wharton, Ohio, in Wyandot County is the geographical center of hot rolled sheet and strip steel capacity, according to the American Iron and Steel Institute. The center has moved west steadily.

Wharton is 16 miles west and six miles south of the town of Seal, Ohio, which was the center when the last determination was made in 1946 on the basis of the "tons-times-miles" method of calculation. Since that time, annual hot rolled sheet and strip capacity has risen more than four million tons to a total of about 30 million tons.

Wharton is a small agricultural community with a population of about 400. It manufactures no steel or steel mill products. The nearest hot rolled sheet mill is at Mansfield, Ohio, about 50 miles to the east.

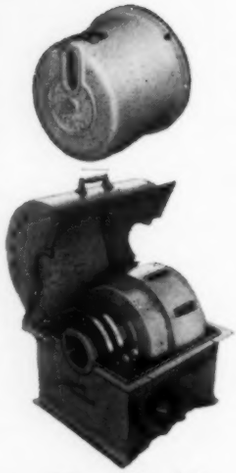
Stearns DOES DOUBLE DUTY ON BIG ALUMINUM MILL!


MAGNETIC BRAKES
Positive action of STEARNS Magnetic Disc Brakes prevents overtravel of adjusting screws.
MAGNETIC CLUTCH
Screwdown drives are synchronized with STEARNS Magnetic Clutch.

LEWIS 4-High Foil Mill

Stopping the adjusting screws on a Lewis mill and holding them positively in position is just the job for STEARNS Magnetic Disc Brakes. Designed with a quick, steady pressure that brings a fast stop in the shortest time, STEARNS Magnetic Disc Brakes prevent overtravel of the adjusting screws and thus allow for careful, positive adjustment. Suitable for horizontal or vertical applications, STEARNS brakes are available in sizes up to torques of 575 pounds feet.

Sychronizing the drive on the screwdowns of large mills requires a rugged, dependable clutch — a STEARNS Multiple Disc Magnetic Clutch. For here's a clutch that is constructed of few and simple parts with no toggles, pins, yokes, shifters or other parts to wear and get out of order. Controlled by a push-button station, STEARNS clutches are available with taper-bores, detachable magnet hub and are furnished fully enclosed in a steel housing. Available in torques and construction to meet your screwdown requirements.



Descriptive literature available. Write today for Bulletin 604-F on brakes, Bulletin 226 on clutches.

Foremost in the Magnetic Field

Stearns MAGNETIC INC.

681 S. 28th St., Milwaukee 46, Wisc.

Lee Wilson

ANNEALING FURNACE DATA SHEET

NUMBER ONE

BASIC ADVANTAGES OF LEE WILSON SINGLE-STACK PORTABLE BASE FURNACES:

1. BETTER QUALITY
2. HIGHER PRODUCTION
3. LOWER FUEL COSTS
4. LOWER FIRST COST
5. LOWER MAINTENANCE
6. LOW HANDLING COSTS

SINGLE-STACK PORTABLE BASE FURNACE IMPROVES PRODUCT QUALITY . . .

Basic design permits Single-Stack Portable Base furnaces to do a job of annealing unsurpassed by any other method. The surfaces of coils in larger multiple-stack furnaces are necessarily at varying distances from the heat source. Tube radiation is limited to but two sides of the charge whether the tubes are along the walls or across the furnace between the coils. (See Figures 1 and 2.)

MORE UNIFORM HEATING AND COOLING

An ideal situation is to have the heat source a uniform distance from the entire surface of the charge, which permits twice as much radiating area. (See Fig. 3.) This arrangement, of course, is only practical in a Single-Stack Portable Base furnace.

CONTROLLED ANNEALING

Too, the Single-Stack Portable Base furnace comes nearest to complete regulation because each furnace is equipped with individual controls. Temperatures and cycles are automatically regulated to meet almost the exact requirements of each charge — resulting in a heating and cooling uniformity unmatched by any other type furnace.

Too, by grouping coils of approximately the same widths and lengths — a comparatively simple operation when using Single-Stack Portable Base furnaces — an even greater measure of control is attainable.

For complete information send for fully illustrated 20-page booklet.

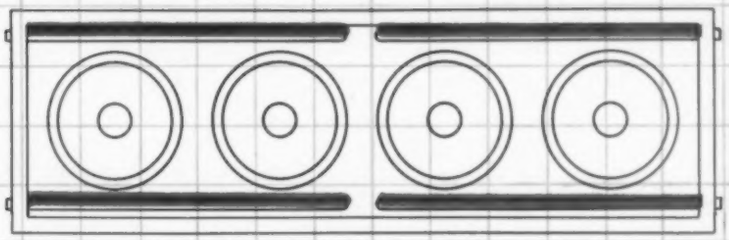


Fig. 1 — In large multiple-stack furnaces there is no practical method for applying balanced heat. The surface of the charge is necessarily at varying distances from the heat source.

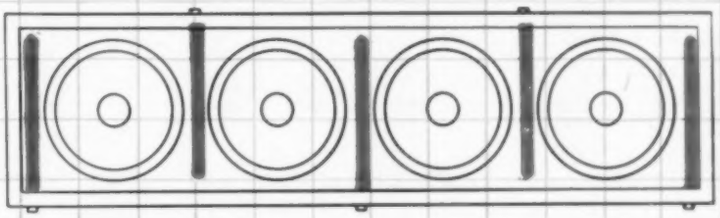


Fig. 2 — Tube radiation is limited to but two sides of the coils whether they are placed along the furnace walls or crosswise between the coils.

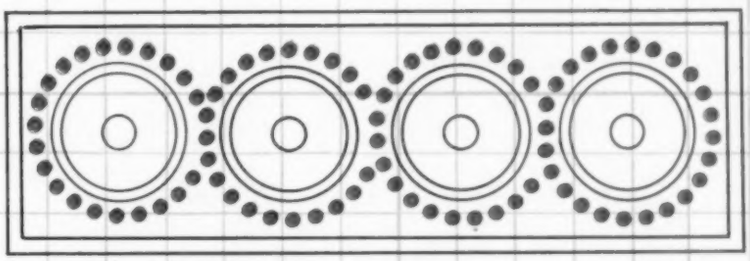


Fig. 3 — This multiple-furnace arrangement would be ideal if it were possible to build.

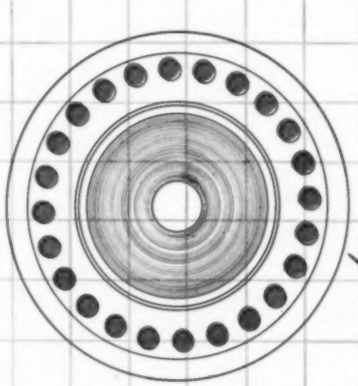


Fig. 4 — The answer to a uniform, controlled heat source is the new Lee Wilson Single-Stack Portable Base furnace. Heat can be applied evenly and efficiently. No overheating or furnace "loafing."

Wharton is 20 miles southeast of Mt. Cory, this country's center of steel-making capacity.

Of the 20 states with hot rolled sheet or strip capacity, or both, Ohio has by far the largest capacity; more than 7.6 million tons. Next largest is Michigan, with nearly 4.2 million tons of sheet and strip capacity. Indiana ranks third and Pennsylvania fourth, each with a little more than four million tons capacity.

USE THE
ENGINEERING MART

SALT FIRM FORMS NEW SALES DEPARTMENT

▲ Pennsylvania Salt Manufacturing Co. has announced the consolidation of all sales and service in chemical specialties for metal cleaning, fabricating and processing in one sales department named the metal processing department.

The department, headed by J. J. Duffy, Jr., sales manager, represents a merger of two groups which have heretofore functioned independently of one another within the company; namely, the Industrial Metal Cleaners Department and the Fos Products Department.

It was also announced that the combination of Sharples Chemicals, Inc. with the Pennsylvania Salt Manufacturing Co. through an exchange of common stock has been effected. Sharples will continue to operate as a separate unit of Pennsalt, with, however, an exchange of technical information and coordination of some policies to the mutual benefit of both organizations.

ERIE MANUFACTURER APPOINTS NEW AGENT

▲ The appointment of the John B. Foley Co. is announced by Zurn Services, Inc., Erie, Pa., as representatives for the sale of Zurn Industrial Division products, which includes the Zurn line of pipe line strainers. This company will service the eastern portion of New York state.

L&N OPENS SALES OFFICE IN ATLANTA

▲ The opening of a sales and service office at 3084 Grandview Avenue, Atlanta, Ga., was announced by Leeds & Northrup Co.

The new office, designed to render prompt service to industry and to educational and scientific institutions in South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee, is the 17th office in the network of Leeds & Northrup branches throughout the country.

Manager of the new office is William A. Macan, III, while the staff includes D. J. McKiever and Raymond Kiehl.

SILICON CARBIDE PLANT IS MOVED

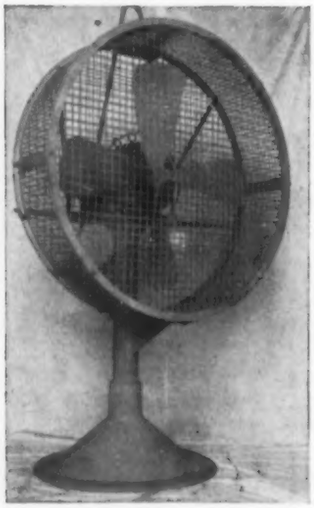
▲ American Metallurgical Products Co. with offices in Pittsburgh will move its manufacturing facilities from Hays, Pa. to New Castle, Pa. The firm is rebuilding property formerly occupied by Consolidated Foundry Co.

The new plant, will have four times the operating capacity of the old one.

IS HEAT SLOWING UP YOUR WORKMEN?

TRUFLO CRANE CAB FANS
For cooling interiors of crane cabs and other confined areas. Adjustable both horizontally and vertically. Four blade type, 12 and 18 in. sizes.

Keep them COOL with TRUFLO FANS



TRUFLO PORTABLE COOLING FANS
Easily portable. Help keep efficiency high where work is hottest. 12 to 36 inch diameters.

Production suffers when workmen are overheated. Steps begin to drag, efficiency falls.

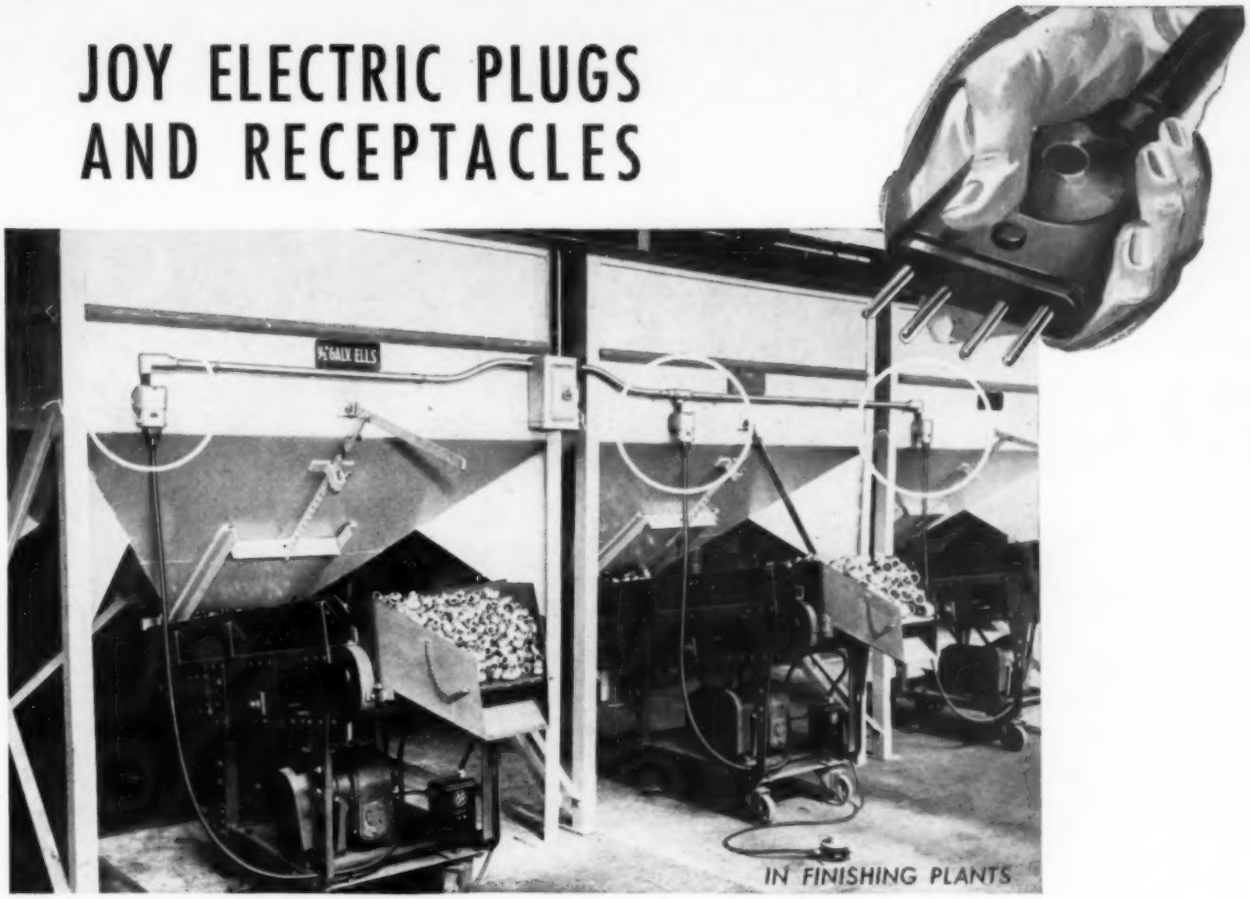
Now, when speedy production is vital, Truflo Fans can help keep your workmen on their toes. All Truflo Fans are designed and built correctly to put fresh cool air *in large volumes* exactly where it is needed. Perfectly-balanced shafts and blades give more air per h.p. . . . strong steel frames stand up longer under hard use . . . rugged wire guards protect men against injuries.

All of the following types can help beat the heat, keep production moving in your plant. Write for illustrated literature.

PORTABLE COOLING FANS
CRANE CAB FANS • WALL FANS
EXHAUST FANS • BLOWERS
ROOF VENTILATING FANS
PENT HOUSE FANS

TRUFLO FAN COMPANY
245 MAIN ST., HARMONY, PA.

JOY ELECTRIC PLUGS AND RECEPTACLES



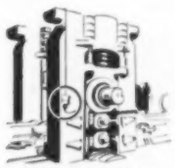
IN METAL PROCESSING PLANTS . . . STEEL MILLS ROLLING MILLS & FOUNDRIES

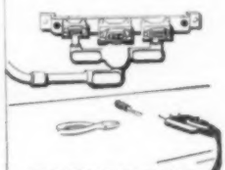
To earn the OK of Heavy Industry, electrical plugs and receptacles must function perfectly for long periods under conditions that quickly destroy many types now available for general industrial needs. That's our reason for believing the growing use of JOY connectors in metal processing plants, steel mills, rolling mills and foundries should be of particular interest to you. We're sure you'll want to know more about their inherent advantages (*see next paragraph*) before placing your next electrical connector order.

Factory molded to cable as one-piece Neoprene units, JOY connectors are little affected by rough handling, hard blows, grime, oil, moisture or vibration. Once installed, little or no maintenance is required. Available in designs and capacities to meet almost any portable power connecting requirement. Why risk electrical connector misfits when today's best actually costs less, in the long run. Full details including free literature available without obligation. Ask for them, today!

ON LIFTING MAGNETS

IN WELDING BANKS


ON ROLLING MILLS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PROGRESS REPORT ON NATIONAL CARBON BLAST FURNACE LININGS

TRADE-MARK

33 BLAST FURNACES lined with "NATIONAL" carbon have now produced over 1 million tons. Of these, 12 furnaces have produced more than 1½ million tons and 4 have passed the 2 million ton mark.

These tonnages are for *original linings*. In every case, production has been characterized by remarkably trouble-free operation.

The term "National" is a registered trade-mark of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
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OTHER NATIONAL CARBON PRODUCTS

BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

Personnel News...

L. F. Coffin was appointed assistant general manager of Bethlehem Steel Co.'s Sparrows Point, Md., plant. Mr. Coffin succeeds **P. F. Dolan** who has retired after 53 years' continuous service in the steel industry. Mr. Coffin, who had been superintendent of the mechanical department, is a past president, and currently honorary director of the Association of Iron and Steel Engineers.

Freeman H. Dyke has been appointed vice president, United States Metal Refining Co. He will also continue as general manager of the plant at Carteret, N. J. Mr. Dyke, who was formerly with Wheeling Steel Corp. and Jones & Laughlin Steel Corp., is a past president of the Association of Iron and Steel Engineers.

H. R. Knust has been appointed superintendent of the mechanical department of Bethlehem Steel Co.'s Sparrows Point, Md., plant, succeeding L. F. Coffin who was recently made assistant general manager. Mr. Knust has been with Bethlehem since 1940.

J. C. Foster has been appointed assistant chief engineer, Bethlehem Steel Co., Bethlehem, Pa., succeeding A. J. Fisher, who recently was made general manager of Bethlehem's Johnstown plant. Mr. Foster has been with Bethlehem since 1928, since 1940 as combustion engineer.

Walter L. Longnecker has been named general superintendent of the Cuyahoga Works, American Steel and Wire division of U. S. Steel Co., Cleveland, Ohio succeeding Nelson W. Dempsey, who recently was appointed assistant manager of operations in the Chicago district. At the same time, **Earle L. Chamberlain** has been appointed division superintendent of the hot mills, succeeding Mr. Longnecker, and **William B. Dawson** has been promoted to Mr. Chamberlain's former post of department superintendent, rolling in the hot mills at Cuyahoga works.

Nelson W. Dempsey, general superintendent of American Steel & Wire's Cuyahoga Works, Cleveland, Ohio, has been appointed assistant manager of operations of the Chicago, Ill., district of this division of U. S. Steel Co. Mr. Dempsey has been general superintendent of Cuyahoga works since September, 1950, having left a similar post at the Wire Division's Waukegan, Ill., plant

K. A. Daugherty has retired effective January 31, as electrical power engineer for the National Tube Division of the U. S. Steel Co., at Gary, Ind., after 48 years' service. Starting at the Lorain, Ohio, works in June, 1904, as an apprentice electrician, he decided at the end of four years in various departments that he needed more schooling. He attended the University of Michigan, where he took his degree in electrical engineering. After continued work in the Lorain skelp mill, where he rose from turn to general foreman, Mr. Daugherty went to the Gary, Ind., plant in 1923 as general foreman of the electrical department. In 1928 he was promoted to assistant superintendent of the electrical department and in 1939 was sent to Ellwood City, Pa., plant, as general foreman of cranes. Since 1942 he has been at the Gary mill in the position of electrical engineer of maintenance and electrical overhead crane engineer.

Philip T. Sharples has been elected to the board of directors of the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. Mr. Sharples is chairman of the board and former president of the Sharples Corp., and Sharples Chemicals, Inc. and is president of the Sharples Oil Co.

M. Nielsen has been named assistant vice president of Babcock and Wilcox Co. He will report directly to the vice president in charge of manufacturing, and will assist in the operations of all of the company's plants in the boiler division, including the new plants at Wilmington, N. C., and West Point, Miss. Mr. Nielsen's headquarters will be at Barberton, Ohio.

John W. Schreiber, a veteran of 42 years with Aluminum Co. of America, Pittsburgh, Pa., retired January 1 as Alcoa's chief construction engineer. He will serve until July 1 as a special consultant on construction. Mr. Schreiber is being succeeded by **L. B. Kuhns,** who was advanced from the position of general superintendent of construction.

L. F. COFFIN

F. H. DYKE

W. L. LONGNECKER

NELSON W. DEMPSEY

ADMIRAL BEN MOREELL | C. L. AUSTIN | A. J. HAZLETT | J. B. MITCHELL

C. L. Austin, executive vice president of Jones & Laughlin Steel Corp., Pittsburgh, Pa., was elected president. **Admiral Ben Moreell,** chairman of the board and president of J&L since 1947, remains as chairman of the board. **Adam J. Hazlett,** vice president—sales, was elected executive vice president—distribution. **John B. Mitchell,** vice president—operations, was elected executive vice president—production. Mr. Austin joined J&L in March 1942 as treasurer and director. He was elected vice president and a member of the executive committee in April 1947. He was elected executive vice president in January of 1948. Mr. Austin was graduated from Princeton University in 1924. He was associated with the Mellon Securities Corp. from 1935 to 1942. He was vice president and director of Mellon Securities just before joining J&L. Mr. Hazlett joined J&L in 1938 as manager of sales, strip and sheet products. He was named assistant general manager of sales in 1942 and was elected vice president and general manager of sales in 1944. Mr. Hazlett

Heroult

ELECTRIC MELTING FURNACE

. . . as ever, the dependable furnace for the production of high-grade stainless, alloy and rimming steels.

Removable roof of new design now available for the larger furnaces.

AMERICAN BRIDGE DIVISION
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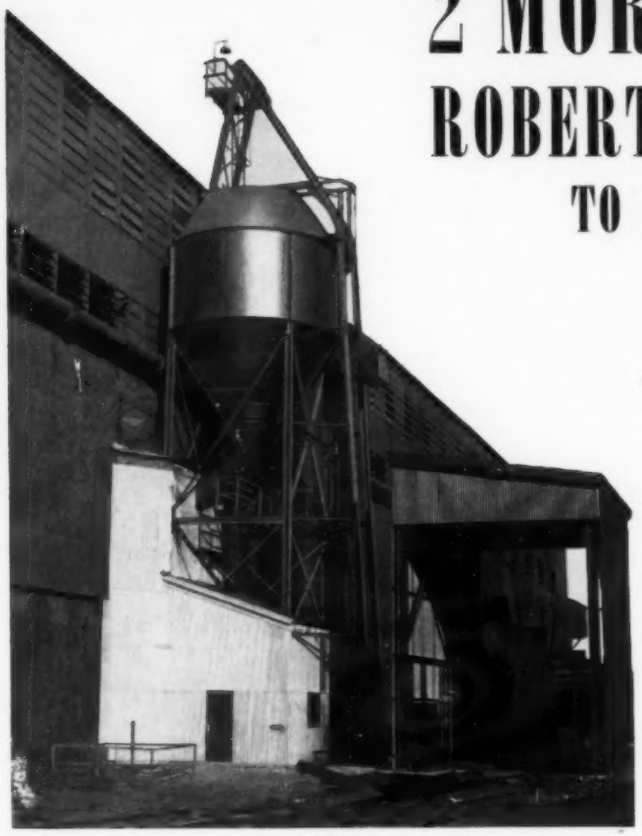
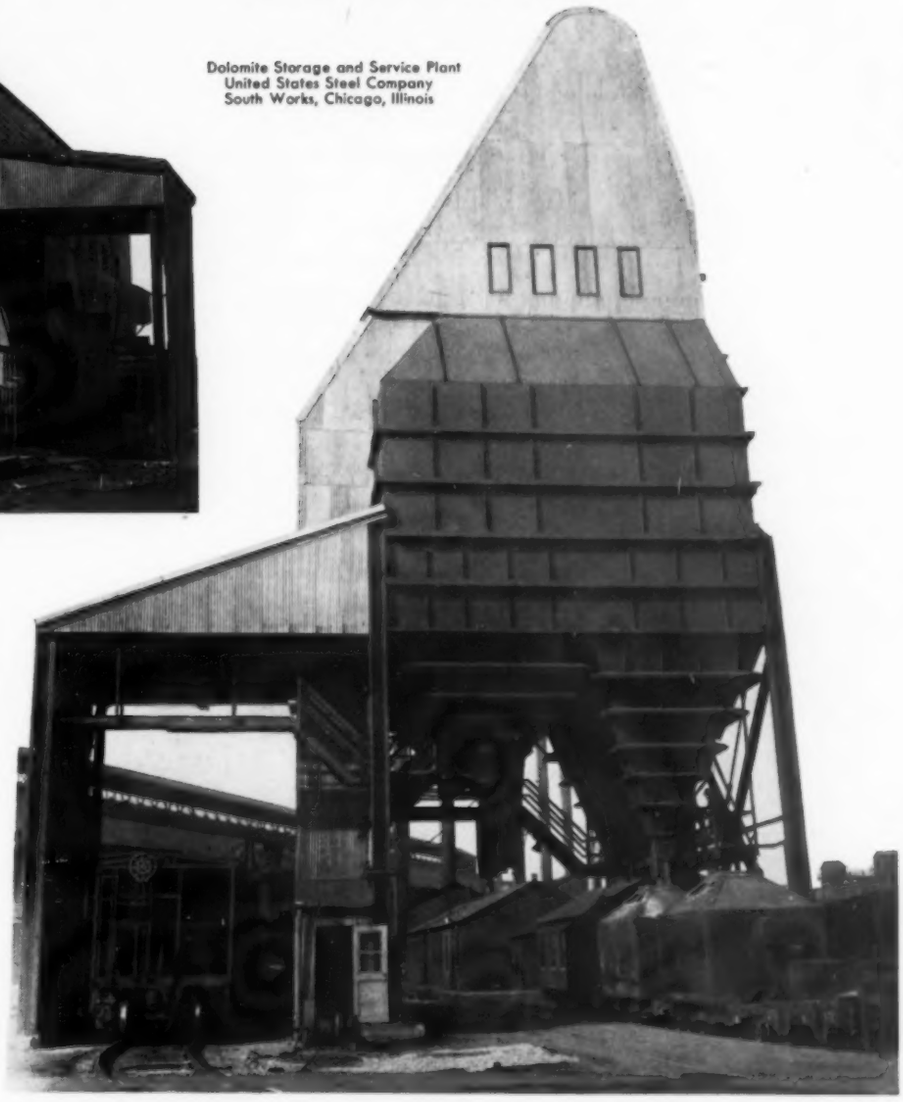
UNITED STATES STEEL

2 MORE
ROBERTS and SCHAEFER ANSWERS TO MATERIALS STORAGE AND SERVICE PROBLEMS



Coke Breeze Storage and Service Plant
United States Steel Company
Gary Steel Works, Gary, Indiana

Dolomite Storage and Service Plant
United States Steel Company
South Works, Chicago, Illinois



Per-ton operating costs of Dolomite and Coke Breeze plants reduced by new Roberts and Schaefer Company installations....

THE two new storage and service plants illustrated here are typical of the ways in which Roberts and Schaefer engineering and construction experience can serve you — and probably save you money — as it has done for many companies in many industries for more than 50 years. Data on plants illustrated available upon request.

Photographs by courtesy of United States Steel Company.

R AND S COMPANY

ROBERTS and SCHAEFER CO.

130 North Wells St. Chicago 6, Illinois

was president and general manager of the Eastern Rolling Mill Co. from 1927 to 1938. He was associated with the West Penn Steel Co. from 1910 to 1919. Mr. Mitchell joined J&L in 1915 in the machine shop of the Aliquippa, Pa., works. He became assistant steam engineer in 1917; was placed in charge of blooming mill and power house engines in 1918; and was named assistant general master mechanic, tin plate department in 1920. In 1925, Mr. Mitchell was named superintendent of the 14 in. bar mill and the maintenance department at the Aliquippa works. In 1934 he was appointed management's special representative in charge of industrial relations. Mr. Mitchell was named superintendent in charge of the blooming mill, the billet and sheet bar mill, the 10 in. skelp mill, and the 14 in. bar mill at Aliquippa in 1937. He was transferred to the Pittsburgh works of J&L in 1938, where he was placed in charge of all bar rolling mills. In 1946 he became assistant to the vice president in charge of manufacturing operations and in 1947, vice president—operations and director.

John A. Borman has been appointed chief engineer of Baker-Raulang Co., Cleveland, Ohio. Mr. Borman will have charge of administration of the engineering department both with regard to new development work and production engineering. He had been serving as chief mechanical engineer.

Maynard M. McMillan has been appointed representative for the Baker line of industrial trucks in the southwestern Ohio territory. Mr McMillan's headquarters will be at 2820 Jessup Road, Cincinnati, Ohio. The territory includes Cincinnati, Hamilton, Middletown, Dayton, Springfield and Portsmouth in Ohio, Covington and Newport in Kentucky, and Lawrenceburg in Indiana. Mr. McMillan has been a member of the Baker sales administration staff since 1940. His first position with the company was sales engineer. In 1944 he was placed in charge of advertising and public relations; in 1945 he was named export manager in addition to his other responsibilities.

George J. Walz, superintendent of the electrical department, Bethlehem Steel Co., Steelton, Pa., retired December 31. **Samuel H. Mumma,** assistant electrical superintendent since 1947, will succeed Mr. Walz. **George D. Nicholson,** formerly an engineer in the electrical department becomes assistant electrical superintendent.

W. G. Smith, assistant superintendent of Bethlehem Steel Co.'s Lackawanna, N. Y., plant, has been appointed assistant general manager. **J. E. Jacobs,** appointed two years ago, also serves in this capacity.

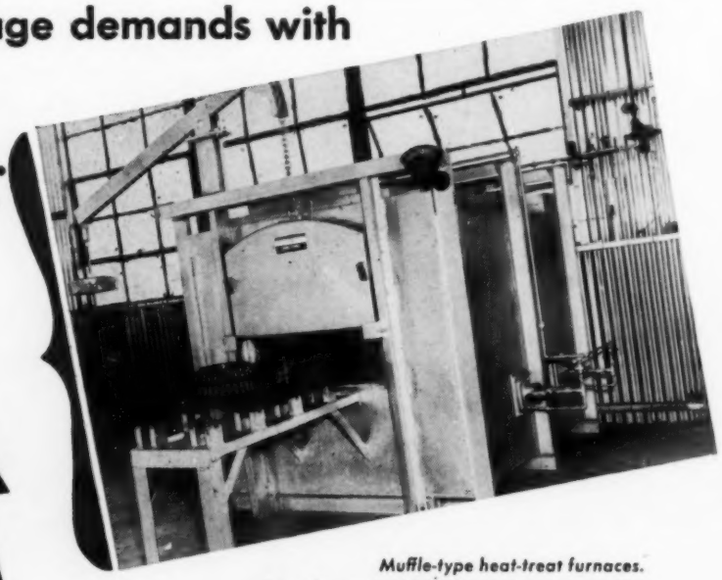
A. M. McIntyre has been appointed St. Louis, Mo., district manager for Electric Controller & Mfg. Co. The new office is located at 1110 S. Brentwood Blvd., St. Louis, Mo.

Robert J. Kroth, formerly of Askania Regulator Co.'s Chicago sales office, has been appointed Philadelphia, Pa., district manager. Mr. Kroth will be located at 1244 Commercial Trust Building.

Meet today's increased tonnage demands with

Custom Engineered

FURNACES by Grant Watson



Muffle-type heat-treat furnaces. One of many individually engineered installations designed, built and installed complete by Grant Watson.

Designers of individually engineered heating and heat treating furnaces, both gas and oil fired, for reheating slabs, billets, rods, bars and blooms; forging; soaking pits; annealing and normalizing; stress relief; and other industrial heating applications.

Grant Watson "Custom Engineered" furnaces deliver maximum heating efficiency, uniform product quality, positive temperature control plus the versatility and flexibility that pays off in increased tonnage and economical operation. Regular COST-FREE SERVICE after installation reduces maintenance costs, assures trouble-free performance day-in and day-out.

Write, wire or call for instant service on custom engineered furnaces to meet your requirements and specifications

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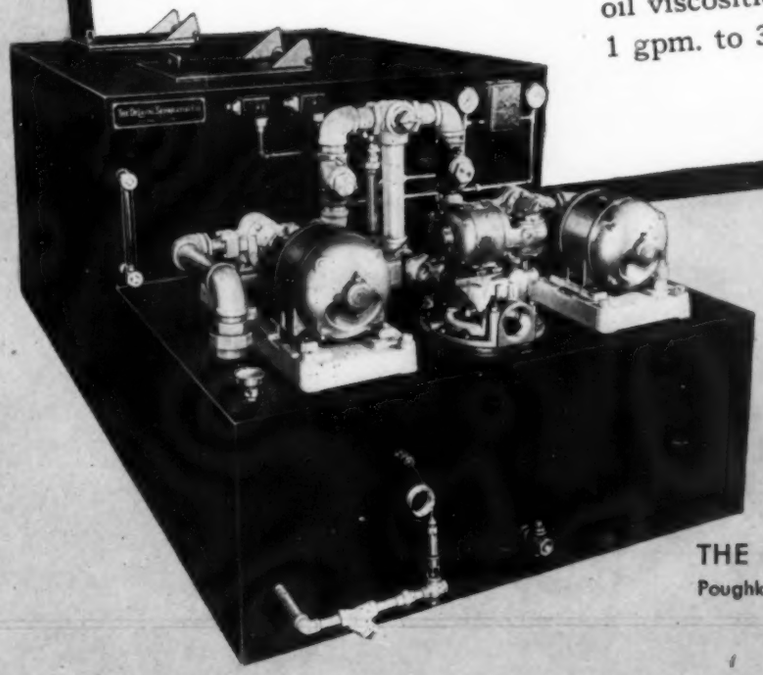
DE LAVAL *UNILUBE* SYSTEMS for Compact, Economical Installation

Unilube Systems were designed to meet the need for a compact, economical full pressure feed lubrication system having all the advantages of the De Laval Custom Designed System.

Unilube Systems are compact integral systems which furnish lubricant in streamline pressure supply to bearings or gear meshing points, and incorporate in a single unit automatic full feed pressure filtration and automatic temperature and pressure control of the lubricant supply.

These systems are furnished completely assembled and ready for operation, thereby minimizing installation cost of both foundations and piping. Further, space requirements are minimized due to compact design made possible by factory assembly.

Unilube Systems are available in four types: namely, single type, simplex type, double type, and dual type — all of which are designed to handle any range of oil viscosities. Capacities range from 1 gpm. to 30 gpm.



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DE LAVAL SALES & SERVICE, INC.
447 Fourth Ave., Pittsburgh 19
DE LAVAL PACIFIC COMPANY
61 Beale St., San Francisco 5

DE LAVAL *ENGINEERED SYSTEMS*

Elmer A. Schwartz has been named assistant vice president, operations for Republic Steel Corp., Cleveland, Ohio, succeeding **M. E. Goetz,** who became manager of Republic's Cleveland, Ohio, district, the position formerly held by Mr. Schwartz.

Frank C. Farrell, manager of Republic Steel Corp.'s Buffalo, N. Y. district, retired to work as a steel consultant for the company in the Buffalo operating and sales department. He is succeeded as Buffalo manager by **Harry L. Allen, Jr.,** formerly assistant district manager. **C. W. Barrett** of Cleveland succeeds Mr. Allen as assistant district manager. **B. F. Handloser,** works manager for many years of the company's Dilworth-Porter Division in Pittsburgh, Pa., succeeds Mr. Barrett as chief roll engineer. **George G. Walker** was named development engineer of the seamless tube mill now under construction at the South Chicago, Ill., plant. He was superintendent of the electric-weld tube mill at Republic's Youngstown, Ohio, plant for nearly 20 years.

J. K. Stafford has joined Atlantic Steel Co., Atlanta, Ga. Mr. Stafford resigned from the Republic Steel Corp. after 35 years to accept his new position.

Leland R. Mansell has been appointed assistant superintendent of the Campbell, Ohio, buttweld tube mills of Youngstown Sheet and Tube Co.

W. H. Johnson has been appointed chief engineer of the Claymont Steel Corp., Claymont, Del. Mr. Johnson was previously assistant chief engineer.

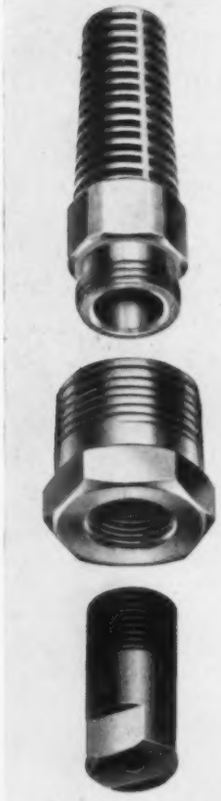
George J. Smith, formerly chief engineer, retired as of November 30, 1951.

Arthur W. Thornton has been appointed assistant general superintendent at the National works of U. S. Steel's National Tube Division at McKeesport, Pa. Mr. Thornton, who succeeds the late William L. Scott,

ARTHUR W. THORNTON

had been division superintendent in charge of pipe production, finishing and shipping.

Rudolph D. Silvern has been appointed sales engineer in the Chicago, Ill., district of Hyatt Bearings Division of General Motors Corp. Mr. Silvern will cover steel mill accounts.



UNIFORM
descaling
with the
Spraying Systems
Descaling Nozzle

This hardened stainless steel nozzle provides a constantly uniform flat spray for clean descaling operations . . . all streaking is eliminated. Available in wide range of capacities.

LARGE DIAMETER ORIFICE

Note that the orifice is almost circular in shape . . . far less tendency to clog than the "old style" slotted orifice. Initial cost is lower. Maintenance cost is lower.

Write for complete information on this quality built nozzle and its large capacity strainer and adapter. Ask for Catalog 22 and Data Sheet 3997.

SPRAYING SYSTEMS CO.
3262 RANDOLPH STREET
BELLWOOD, ILLINOIS
(Suburb of Chicago)

Heavy Nose, Super-Cooled Bosh Plates — for the Tuyere Zone where plates are most apt to burn.

BLAST FURNACE COPPER CASTINGS

Tuyeres - Tuyere Coolers
Cinder Notches - Notch Coolers
Bosh Plates - Mantle Plates
Hot Blast Valves and Valve Seats

Standard, Special and most Patented Designs to your specifications.

SMEETH-HARWOOD COMPANY
2401-09 West Cermak Road, Chicago 8, Illinois

Superior* Blast Furnace Copper Castings *Exclusively

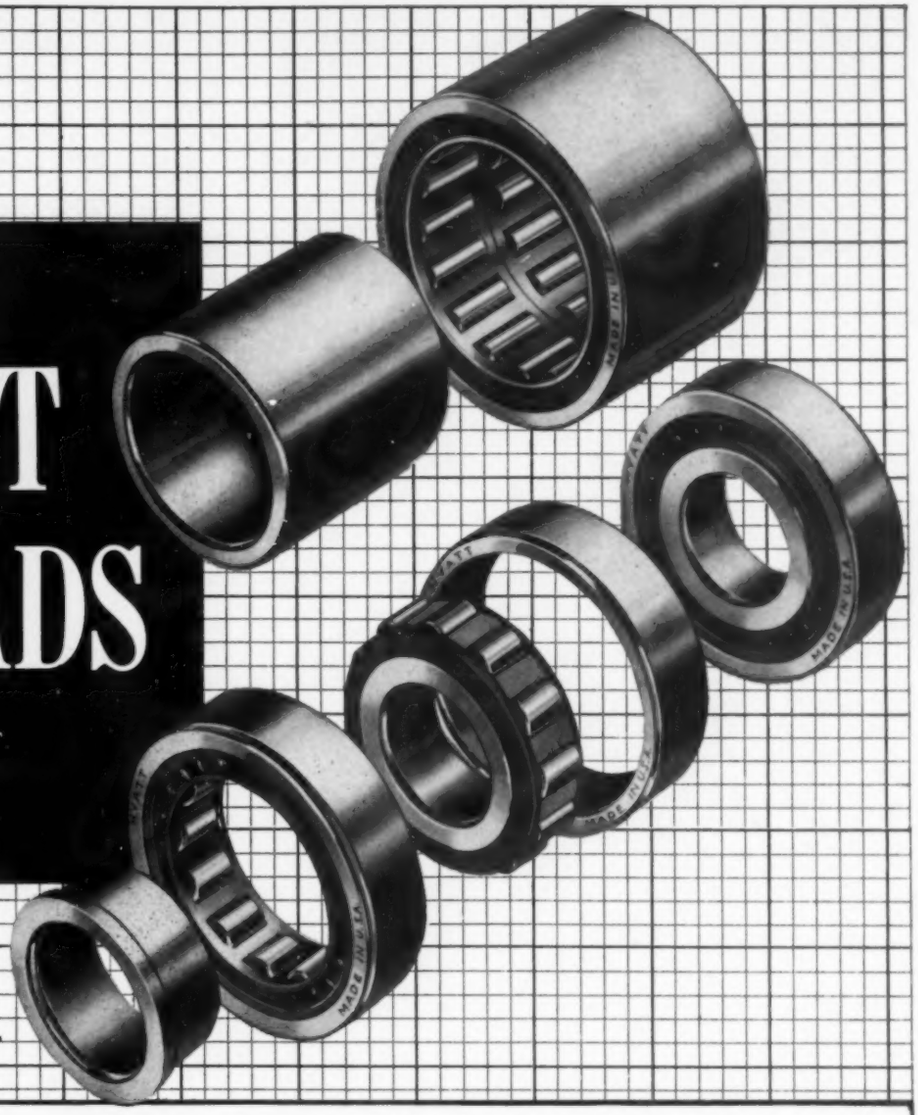
Cinder Notch

SMEETH-HARWOOD Hot Blast Valve Seats — *the recognized standard of dependability*

Refractory Lined Safety Coolers

Steudel Tuyere shaped to eliminate cutting underside of nose

HYATT HY-LOADS



Your best bearing bets—

THE Hyatt Hy-Load line of cylindrical roller bearings, for radial loads or light or intermittent thrust loads, are made in two diameter series, wide and narrow widths, and to standard boundary dimensions.

There are ten different types of Hyatt Hy-Load Roller Bearings. Four have separable inner races, two have separable outer races, and four are non-separable. There is also the duplex, or double-row type of Hyatt Hy-Load with a separable inner race.

* * *

Hyatt Roller Bearings have, for years, given top-quality service in tables, cranes, cars, mill motors and other steel mill equipment. For new equipment or changeovers Hyatts are the preferred roller bearings. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

LINTERN
AIRE-RECTIFIERS
THE ORIGINAL SPLIT SYSTEM
The Choice of those Who Know

■ Following is a partial list of users of Lintern Aire-Rectifiers. Without exception, the original installation has been followed by repeat orders.

We value highly the confidence thus expressed in our product.

Allegheny-Ludlum Steel Corporation
Aluminum Company of America
Cleveland, O., Tennessee, Texas and Davenport, Iowa Plants
American Steel & Wire Company
Atlantic Steel Company
Bethlehem Steel Corporation
Bethlehem, Lackawanna, Steelton, Sparrows Point and Johnstown
Birmingham Slag Company
Canadian Carborundum Company
Colorado Fuel & Iron Company
Columbia Steel Company
Dominion Steel Foundries Ltd.
Electro-Metallurgical Company
Ford Motor Company
Detroit and Canadian Plants
Geneva Steel Company
Great Lakes Steel Corporation
Inland Steel Company
Jones & Laughlin Steel Corporation
Kaiser Steel Corporation
Kennecott Copper Company
Keystone Steel & Wire Company
Laclede Steel Company
McClouth Steel Corporation
National Tube Company
Lorain, Gary and McKeesport Works
Newmont Mining Company
Newport Steel Corporation
Northwestern Steel & Wire Company
Page Hershey Tubes Ltd.
Pittsburgh Metallurgical Company
Pittsburgh Plate Glass Company
(Columbia Cement Division)
Republic Steel Corporation — *Cleveland*
Reynolds Alloy Corporation
Rotary Electric Steel Company
Standard Steel Spring Company
Southern Acid and Sulphur Company
Stanley Works,
American Tube and Stamping Plant
St. Lawrence Alloys Company Ltd.
Timken Roller Bearing Company
U. S. Navy
U. S. Steel Company
Ohio, Gary, South, MacDonald and Fairless Works
Weirton Steel Company
Westinghouse Electric Company
West Virginia Pulp & Paper Company
Wheeling Steel Company
Wisconsin Steel Company
Youngstown Sheet & Tube Company
Indiana Harbor

Lintern Aire-Rectifiers have been installed also on cranes for England, France, South Africa, and Chile.

SUCH *Preference* MUST BE MERITED

THE LINTERN CORPORATION
29-2 RIVERSIDE DRIVE • BEREA, OHIO

Harry J. Conlan, assistant division engineer of the eastern sales division of Hyatt Bearings Division of General Motors Corp., Harrison, N. J., has been transferred to the Pittsburgh, Pa., office to a similar position for the central sales division.

Robert S. Mercer has joined Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., as sales engineer on corrosion resistant products.

J. R. Chegwidden has been named assistant superintendent of Saucon division, Bethlehem Steel Co.,

J. R. CHEGWIDDEN

Bethlehem, Pa., succeeding **George H. Todd,** retired. Other changes are: **Robert W. Couch,** superintendent of Saucon electrical and mechanical maintenance, becomes superintendent of Saucon mills and shipping yards. **Frederick L. Wise,** assistant superintendent of Saucon electrical and mechanical maintenance, be-

ROBERT W. COUCH

comes superintendent of the same department. **Elwood Stoddard** is advanced from general maintenance foreman, alloy and tool division, to assistant superintendent of Saucon electrical and mechanical maintenance.

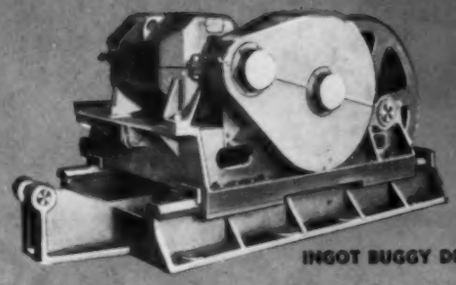
Robert A. Weisse was named assistant sales manager of Kaydon Engineering Corp., Muskegon, Mich.

L. J. Carson, former general manager of Link-Belt Co.'s Minneapolis, Minn., plant, has resigned from his position as price executive of Machinery Branch of the Industrial Materials and Manufactured Goods Division of OPS in Washington, D. C., and has been named

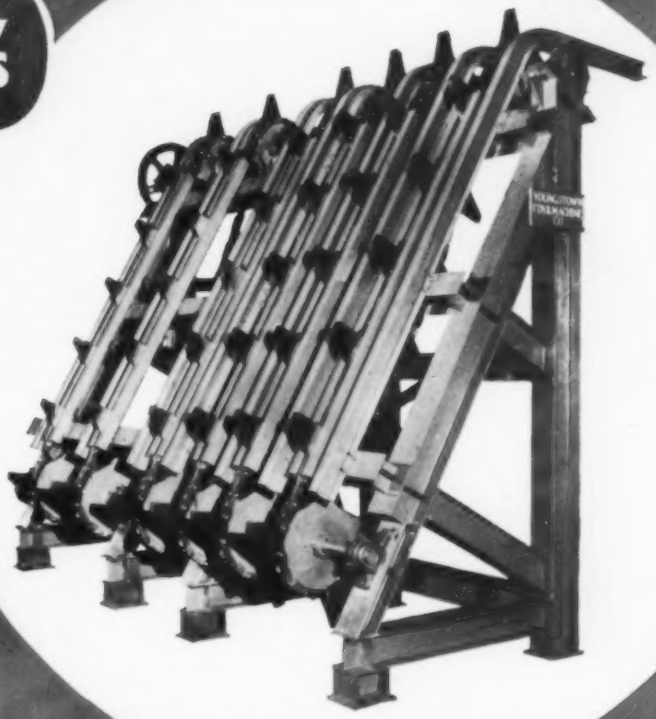
STEEL MILLS Rely on Y&M

for **MACHINES, EQUIPMENT, ROLLS AND CASTINGS**

SCRUBBER and CLEANING LINE



INGOT BUGGY DRIVE

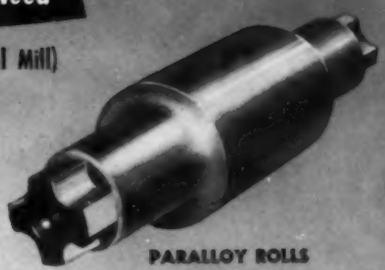


60° INCLINE BILLET ELEVATOR

Check this List for the Products You Need

- PARALLOY ROLLS (Pinch, Coiler, Tension, Steel Mill)
- HYDRAULIC SLAB AND BILLET PILERS
- STRIP AND SHEET OILING EQUIPMENT
- SHEET SCRUBBER AND CLEANING LINES
- HOT SAWS—ROCKING AND SLIDE TYPES
- HOT BEDS—COOLING BEDS—TRANSFERS
- BILLET EJECTORS—PINCH ROLL STANDS
- SLITTERS—SPECIAL SHEARS AND GAUGES
- TILTING TABLES—Traveling and Lifting Tables
- Continuous PICKLING Lines—ROLLER LEVELERS
- FURNACE Charging Equipment—Furnace Pushers
- Strip Steel COILERS and REELS—SCRAP BALLERS
- RAILROAD Spike Forming Machines—ROLL LATHES
- Sheet GALVANIZING Lines—Wire Patenting Frames
- Stretcher Levelers—Angle and Shape Straighteners
- Rolling Mill Tables—Gear and Individual Motor Types
- DUCTILE CASTINGS (80,000 PSI.)

Machinery Built to Customer's Design and Detail Drawings



PARALLOY ROLLS

WELDED GEAR REDUCER

42" ROLL LATHE

The Youngstown Foundry & Machine Co.

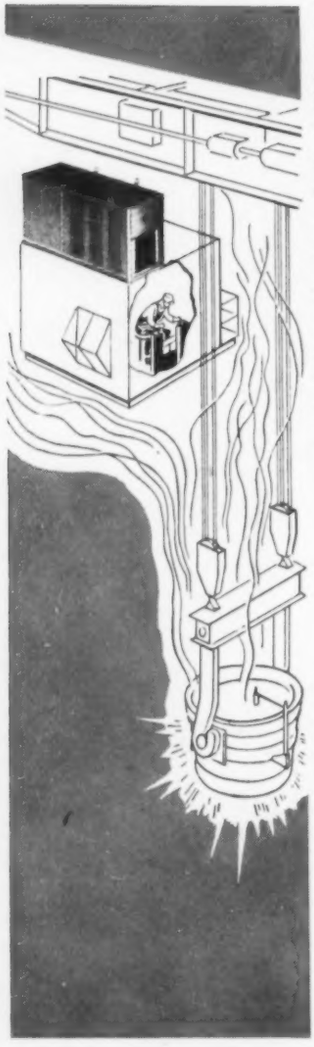
OVER SIXTY YEARS OF SERVICE TO THE STEEL INDUSTRY

Youngstown, Ohio

6★

DRAVO CRANE CAB COOLERS

cool off the HOT SPOTS



Extreme temperatures ranging as high as 225° F. in crane cabs operating over soaking pits, ladles, chargers, and similar "hot spots," reduce the alertness, efficiency, and health of crane operators.

Dravo Crane Cab Coolers maintain comfortable working conditions and supply clean, pure air to men working under adverse conditions—with a consequent substantial improvement in the overall safety and production of the department served.

AVAILABLE IN EITHER SELF-CONTAINED OR SPLIT-TYPE UNITS

Dravo Crane Cab Coolers are built in two models—the self-contained unit, mounted on any available space on the crane, and the split-type unit.

Split-type units are ideal where cabs are located in the center of the crane, because the condenser section is in the cab with the operator, the two sections joined only with refrigerant pipe and electrical connections.

IMMEDIATE DELIVERY AND QUICK INSTALLATION

The Dravo Crane Cab Cooler can be easily and quickly installed on any type of crane with a minimum of down-time required. Units are available now. Write for more information—or phone the nearest Dravo office and have our representative call on you.

DRAVO CORPORATION

602 Dravo Building, Fifth & Liberty Avenues, Pittsburgh 22, Pa.
ATLANTA • BOSTON • CHICAGO • CLEVELAND • DETROIT
NEW YORK • PHILADELPHIA • PITTSBURGH

general manager of Link-Belt's new Colmar, Pa. plant. This plant is now under construction and is scheduled to be in operation during the last quarter of 1952.

Ross E. Willis was elected a director of the Mesta Machine Co., Pittsburgh, Pa. Mr. Willis began his

ROSS E. WILLIS

career at the Duquesne, Pa., plant of Carnegie Steel Co., at present a works of United States Steel Co., and subsequently served with the Cambria Steel Co. at Johnstown, Pa., and Pennsylvania Steel Co. at Steelton, Pa., both of the latter now a part of Bethlehem Steel Co. Later he was general sales manager of the Ready Power Corp., Detroit, Mich. He has been associated with the sales department of Mesta Machine Co. since 1931.

John D. Iversen has been appointed to the position of general superintendent of the Mesta Machine Co., Pittsburgh, Pa., succeeding the late **John R. Berg.** Mr. Iversen started in the engineering department of the company in 1935 and was transferred to the open hearth department in 1936. From 1937 to 1942 he was superintendent of the electric steel products division, and after a transfer to the general superintendent's office, he was appointed manager of the Navy plant of

JOHN D. IVERSEN

the company. In 1945 he was made assistant to the general superintendent.

Robert Picchietti has been named purchasing agent for Kling Bros. Engineering Works of Chicago, Ill.

HAGAN *Air-Operated* Controls and Ring Balance Meters are *Designed* for dependable combustion control in steel mills

SOAKING PITS

COKE OVENS

BLAST FURNACES

REHEATING FURNACES

GAS DISTRIBUTION SYSTEMS

BESSEMER CONVERTERS

BOILER HOUSES

OPEN HEARTHS—wherever combustion control and metering problems occur in steel mills, Hagan Air-Operated Controls and Ring Balance Meters will assure dependable control.

Hagan Engineers will be glad to help you solve your metering and combustion control problems. Write to:

HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

METALLURGICAL FURNACE CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
BOILER COMBUSTION CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

C. E. Cromwell has been appointed sales manager of the commercial division of the De Laval Steam Turbine Co., Trenton, N. J. Mr. Cromwell had been district manager in Detroit, Mich.

C. D. King was appointed assistant vice president and chairman—engineering committees, United States Steel Co., Pittsburgh, Pa.

C. D. KING

D. V. Sherlock of Mt. Lebanon, recently retired as vice president of Blaw-Knox Co. and manager of its Union Steel Castings Division, has been recalled to assume the position of acting manager of the Blaw-Knox Division at Blawnox, Pa.

Fred P. Biggs has been elected a vice president of American Brake Shoe Co., New York, N. Y. Mr. Biggs is also president of the company's Brake Shoe and Castings Division.

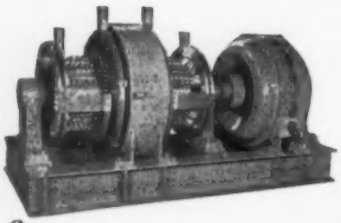
J. H. Tredinnick, former vice president in charge of the Hastings, Mich., division, has been named executive vice president of E. W. Bliss Co., Canton, Ohio.

J. H. TREDINNICK

Mr. Tredinnick will be located in the company's executive offices at Canton, Ohio. **Robert Shannon** was appointed as the new manager of the Hastings, Mich., division at the same time. He was previously assistant manager of this division.

COLUMBIA

MOTOR GENERATORS



for • Electroplating
• Anodizing
• Electrocleaning
• Electropolishing

TONG TEST
A. C. — D. C. ➡
AMMETERS

• TANK RHEOSTATS
• REVERSING SWITCHES

Write for Descriptive Bulletins

COLUMBIA ELECTRIC MFG. CO.
4543 HAMILTON AVE. CLEVELAND 14, OHIO

BROWNING
MILL TYPE CRANES have
Plenty of Strength WHERE
STRENGTH IS NEEDED!

Browning Mill Type Cranes are built in accordance with A. I. S. E. specifications. They incorporate the types of motors and controls on which your mill or industry has standardized. This flexibility adapts your VRB crane *perfectly* to your needs. Only the finest materials are employed. Browning heavy duty cranes meet the most rigid demands and satisfy the most critical users. Our design, placing plenty of strength wherever needed, is the outgrowth of 48 years' experience in the crane industry.

Write for our Bulletin "E".

"Built as you yourself would build them"

VRB

VICTOR R. BROWNING & COMPANY, Inc.
BOX 309, WILLOUGHBY (CLEVELAND), OHIO
Designers and Builders of Electric Overhead Traveling Cranes and Hoists and Electric Revolving Cranes

an evergrowing list of satisfied customers

Throughout industry, leading builders and users of virtually every type of mechanical equipment rely on Torrington Bearings for long, trouble-free service under the most exacting operating conditions.

They rely on Torrington Engineers, too, for experienced assistance on design, installation and maintenance problems involving every type of anti-friction bearing. Why not tell us about *your* problem? We'll welcome the opportunity of serving you.

THE TORRINGTON COMPANY

South Bend 21, Ind. Torrington, Conn.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Straight Roller • Needle • Ball • Needle Rollers

Thomas J. Moore, Jr. was made general manager of the Brainard Steel Division, Sharon Steel Corp., Warren, Ohio. Mr. Moore was vice president of Brainard before the recent designation of Sharon Steel's subsidiaries as operating divisions. **E. T. Sproull,** formerly president of Brainard, will serve as chairman of the management committee, and **William J. Keegan,**

T. J. MOORE, JR.

formerly secretary and treasurer, is now assistant general manager.

George L. Jordy has been appointed manager, Chimney division, of Rust Engineering Co. Formerly assistant manager of the division, Mr. Jordy succeeds **Eric Plagwit** who was elevated to the newly created position of special representative and chimney consultant.

Murray Whitfield, who has been identified with the manufacture and distribution of electrical equipment and supplies for the past 24 years, has been named executive vice president and sales director of Revere Electric Manufacturing Co., Chicago, Ill.

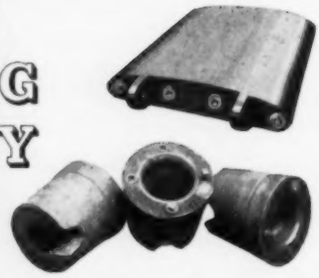
George E. Goodrich was appointed to the position of assistant manager, industrial department, of Westinghouse Electric Corp.'s apparatus division, East Pittsburgh, Pa. Prior to his present promotion, Mr. Goodrich was resale manager of the company's middle Atlantic district with headquarters in Philadelphia, Pa.

Mr. Goodrich, whose entire business career has been with Westinghouse, joined the company in 1934 enrolling in the graduate student course. On completing the course, he was assigned to the general sales department at East Pittsburgh, transferring in 1936 to the Philadelphia sales office. From 1940 until 1943, Mr. Goodrich was employed as an application engineer, first in the York (Pa.) office and subsequently in Philadelphia. Four years later he assumed the duties of middle Atlantic district resale manager. He is a graduate of Lehigh University with a Bachelor of Science degree in industrial engineering.

J. A. Sizer was elected president of Industrial Gear Manufacturing Co., Chicago, Ill. He was formerly vice

ANOTHER FALCON CONTRIBUTION

TO OPERATING EFFICIENCY



If air could conduct heat better than water, you would circulate air through your copper cooling plates. But you are aware of what trapped air does to a tuyere or to a bosh plate. It has been a major threat to operating efficiency . . . and Falcon non-ferrous casting specialists have come up with the answer. Falcon has created an AIR-FREE COOLING PLATE and an AIR-FREE TUYERE. It is another of the many examples of Falcon pioneering . . . constantly affording you the current best in copper castings, through specialization . . . and contributing immeasurably to longer equipment life and maximum reduction of down-time.

• • • • • • • • • • •

For Blast Furnace Copper Castings delivered when you want them . . . and in the best quality

Telephone Collect 3-4186

FALCON BRONZE CO.

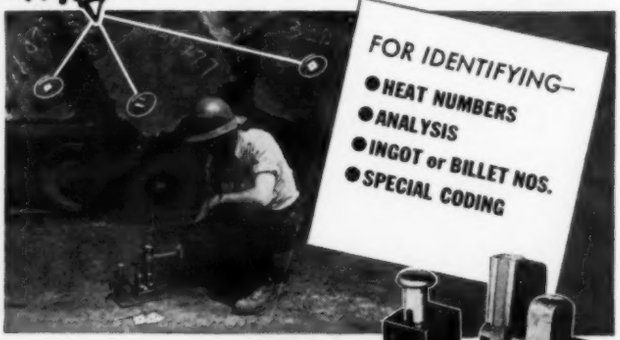
YOUNGSTOWN 3, OHIO

Established 1890 · Incorporated 1895

Licensed Manufacturers of All Patented Designs

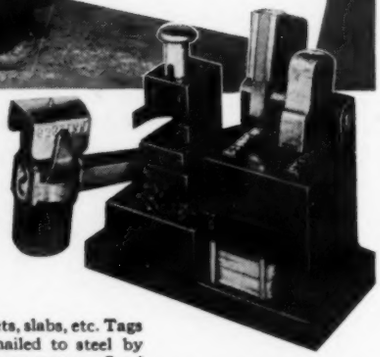
DEPENDABLE FOR 61 YEARS · SINCE 1890

NAIL IDENTIFICATION TAGS TO STEEL!



—with the

"SAFETY" TAG EMBOSSING and TAGGING OUTFIT



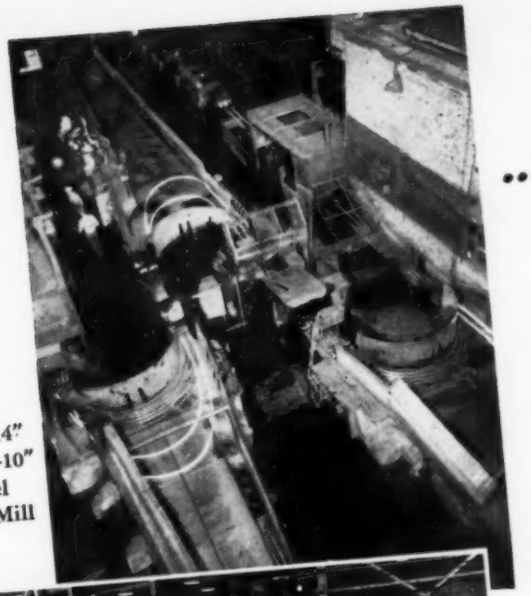
It's hard to believe, but it's true—this Outfit enables you to quickly nail metal identification tags to hot or cold steel ingots, billets, slabs, etc. Tags are embossed, pierced and nailed to steel by swinging hammer in the ordinary manner. Send for complete data today on this remarkable unit.

Write for Bulletin J-547

M. E. CUNNINGHAM CO.

SAFETY STEEL STAMPS

105 East Carson Street • Pittsburgh 19, Pa.



View of 14"
—12"—10"
Mild Steel
Rod Mill

...When it's tonnage that counts

depend on

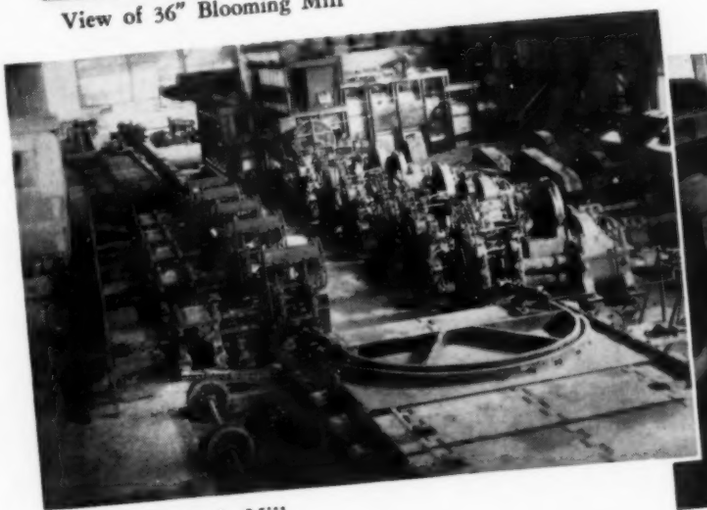
BIRDSBORO

STEEL MILL MACHINERY

For producing Blooms, Billets, Rod, Strip and Merchant Bar.

Birdsboro engineering skill makes possible modern equipment like this that you'll find in leading mills mass-producing billets, rod, sheet, strip, plate and other products to meet today's critical demands. Whenever you find it necessary to modernize your present equipment or add to your facilities—it may be this year or the next—Birdsboro engineers will be glad to work with you on your individual problems.

View of 36" Blooming Mill



View of 10" Strip Mill

View of Merchant Mill

BIRDSBORO

STEEL FOUNDRY & MACHINE CO.

Birdsboro, Penna.

STEEL MILL MACHINERY

Designers and Builders of:

Steel Mill Machinery • Crushing Machinery • Rolls
Hydraulic Presses • Special Machinery • Steel Castings

Offices in:
Birdsboro, Pa. and
Pittsburgh, Pa.

MM-16-51-R

president of the company, in charge of sales. Mr. Sizer succeeds **A. M. Scharek,** founder of the firm, who was elected as chairman of the board and chief executive officer.

Fred W. Richardson was named general superintendent of Heppenstall Co.'s Pittsburgh, Pa., plant. He succeeds **Paul H. Daley,** who was recently named general manager of the 35-acre plant at Eddystone, Pa., which Heppenstall is reactivating to manufacture die blocks as part of the expansion program of the U. S. Air Force.

Chester H. Lehman, identified with Blaw-Knox Co., Pittsburgh, Pa., for 42 years, announced his retirement as executive vice president of the company. At the same time, W. Cordes Snyder, Jr., president, announced that Mr. Lehman will continue as a director and vice chairman of the board of Blaw-Knox Co., and that he will also serve in an advisory and consulting capacity to the president.

A. H. Stromeier was appointed sales engineer for the tubular division of Aetna-Standard Engineering Co., Pittsburgh, Pa.

J. E. Hovis has been named general manager of Bloom Engineering Co., Inc., Pittsburgh, Pa. **H. J. Howe** was appointed secretary.

Thomas T. Phipps, of Surface Combustion Corp., has been appointed sales engineer in the Cleveland, Ohio, territory for the heat treat division. In this new capacity, Mr. Phipps will be handling all lines of standard industrial furnace and burner equipment.

Ralph J. Carothers has been named chief inspector at the Beaver Falls, Pa., plant of Tubular Products Division, Babcock & Wilcox Co. Mr. Carothers has been with the company's inspection department at Beaver Falls since 1929. He succeeds **James A. DeBee** who died recently as a result of an automobile accident.

H. S. Garrett and **J. V. Christman** were appointed assistant purchasing agents for Wagner Electric Corp., St. Louis, Mo. **M. W. Cox** was named supervising buyer.

Fred Schuchman and **James E. Seifert** were appointed field sales managers for the Hypressure Jenny Division of Homestead Valve Manufacturing Co., Coraopolis, Pa. Formerly, national accounts representative, Mr. Schuchman will be in charge of the eastern district; while Mr. Seifert was moved up from sales promotion manager to management of the central district. **Garrett E. Winner** has been advanced to fill the post of sales promotion manager.

Adin B. Capron has been named to the newly created post of chief engineer of the Tubular Products Division of Babcock & Wilcox Co. Because of an extensive expansion program under way at both the Beaver Falls, Pa. and Alliance, Ohio, plants of the division a number of engineering functions at both plants have been centralized under the new position. Mr. Capron's headquarters will be at Beaver Falls and he will direct the activities of the drafting, engineering development, maintenance, combustion and methods engineering groups and be in charge of all plant construction.

We are now equipped with Farrel-Sykes Machines to cut Herringbone Gears up to 61" in diameter—18" face. We can handle production runs or single lots of Spurs, Bevels, Mitres, Worms, or any type Gears, Racks or Sprockets, as specified. Make our plant your source of supply.

Industrial Gear

See us at work.
Write for Bulletin 151.

4527 W. VAN BUREN STREET • CHICAGO 24, ILL.

Hyde Park

STEEL MILL EQUIPMENT

Roll Turning Lathes — Roll Tables
Mill Stands — Stretcher Levellers
Sheet Pack Carriers — Mill Shears
Surface Plates — Floor Plates
Mill Reduction Drives

RED CIRCLE Rolls ALLOY-CHILLED

CHILLED and ALLOY IRON ROLLS

GRAY IRON CASTINGS

Inquiries invited

HYDE PARK FOUNDRY & MACHINE CO.

HYDE PARK, PA. (PITTSBURGH DISTRICT)

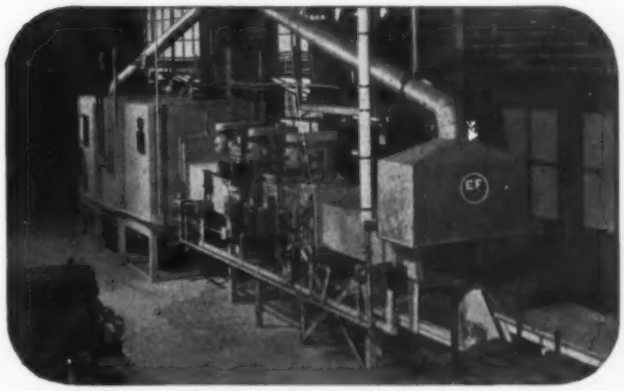
Straight lengths of brass and copper tubing are also bright and scale-free annealed in this EF gas fired furnace. Capacity 4000 lbs. per hour.

EF gas fired forced convection continuous roller hearth special atmosphere furnace bright annealing long straight lengths of tubing.

ANNEALING TUBING BRIGHT *and* CLEAN *Continuously*

• We have built many outstanding production furnaces for processing copper, brass, stainless, aluminum, nickel silver and other ferrous and non-ferrous tubing . . . in large and small coils . . . straight lengths, long and short, and in various diameters . . . also for many other products and processes.

Put your production furnace problems up to experienced engineers . . . *it pays.*



A special atmosphere belt conveyor electric furnace annealing short lengths of alloy tubing—operates at temperatures up to 2040° F.

3000 lbs. of steel tubing, per hour, are bright normalized in this EF gas fired radiant tube type special atmosphere furnace.

Straight lengths of tubing up to 5" in diameter and ¾" thick are also annealed in this EF forced circulation roller hearth furnace.

Gas-Fired, Oil-Fired EF and Electric Furnaces

for any Process, Product or Production

THE ELECTRIC FURNACE CO.

WILSON ST. at PENNA. R. R. *Salem - Ohio*

Dr. Kent R. Van Horn has been appointed director of research for Aluminum Co. of America, Pittsburgh, Pa. A veteran of 22 years with Alcoa, Dr. Van Horn will advance from the position of associate research director to succeed **Dr. Francis C. Frary,** who is retiring.

Dr. William A. Thomas has joined the engineering staff of Electric Products Co., Cleveland, Ohio. From 1940 to 1948, Dr. Thomas was an electrical engineer with the E. I. du Pont de Nemours, Inc., at Wilmington, Del. In 1948, Dr. Thomas returned to Case Institute of Technology as professor of electrical engineering.

Edward R. Anderson has been appointed president of the American Forge Division and **William E. Crocombe** has been made assistant to the chairman of American Brake Shoe Co., New York, N. Y. Mr. Anderson was a vice president of the Brake Shoe and Castings and Kellogg Divisions. Mr. Crocombe, president of the American Forge Division for 28 years, has reached normal retirement age, but he will continue to be available for special assignments by the chairman of the board.

J. H. Metzgar has been appointed sales manager of the standard products division of the De Laval Steam Turbine Co., Trenton, N. J.

C. S. Jones and **J. R. Conley** have been appointed district representatives for General Electric's Construction Materials Division. Mr. Jones has been assigned to the north central district and will be responsible for wiring device and accessory equipment products. His office will be at 5726 W. 51st Street, Chicago, Ill. Mr. Conley will be wire and cable specialist in the north central district with offices at 2431 Hennepin Avenue, Minneapolis, Minn.

John A. Hartzell has been promoted to the position of sales manager, Engineering and Construction Division of Koppers Co., Inc. Mr. Hartzell, who started work with Koppers in 1922 as a draftsman, succeeds **Ward L. Gable,** who has retired but will remain with Koppers as a special sales consultant. Also announced were the appointsments of **C. W. Mohme** as assistant to the production manager, **C. K. Waibel** as a sales engineer and **C. E. Mielke** and **H. A. Grosick** as contract engineers.

Dan E. Winslow, Jr., has been transferred to Pennsylvania Transformer Co.'s New York, N. Y., district sales office to replace **J. B. Sullivan,** who has returned to headquarters sales in Canonsburg, Pa. Mr. Winslow, formerly a headquarters sales engineer, will be primarily responsible for contacting utilities and industrials in northern New Jersey. Mr. Sullivan returns to headquarters sales after two years' service in New York to assume duties as a special application engineer.

Obituaries

Jan R. Dunsford died January 13. Mr. Dunsford was a manufacturers' representative in the Pittsburgh, Pa., district for several industrial firms.

Leonard A. Yoder, 55, died after a short illness in Stamford, Conn. Since 1945 Mr. Yoder has been a partner in the firm of Jones & Yoder, New York machinery distributors and representatives of Yoder Co. In 1935 he started to work in the engineering department of Yoder Co., Cleveland, Ohio, specializing in tube mill and cold roll forming machinery. From engineering he went into the sales department and during the last war served as a superintendent of the shell division of this company.

J. D. Cashman of Detroit Ball Bearing Co. of Michigan, Detroit, Mich., died December 25.

Ernest Cravatte, general manager of S. A. Talleres Metalurgicos San Martin, Buenos Aires, Argentina, died January 5.

Richard A. Metcalf, 42, sales manager of Miller Electric Manufacturing Co., Appleton, Wisc., died suddenly on December 20.

Robert T. Johnson, 58, died January 28. He was associated with the Hill-Acme Co., the Northern Engineering Works and the Economy Baler Co. as the Pittsburgh, Pa., district representative.

John R. Berg, 63, died January 8, in Pittsburgh, Pa. Mr. Berg was vice president and general superintendent of Mesta Machine Co. He was also a director of the company. Mr. Berg was in his 49th year with the Mesta Machine Co. and was active up to the time of his death.

Ray M. Fenton, 58, district engineer of the Youngstown Sheet and Tube Co., Youngstown, Ohio, died January 19.

WHAT'S THE FASTEST WAY TO CLEAN METAL?
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9
Some good things to know about Metal Cleaning

Oakite's FREE Booklet

"Some good things to know about Metal Cleaning"

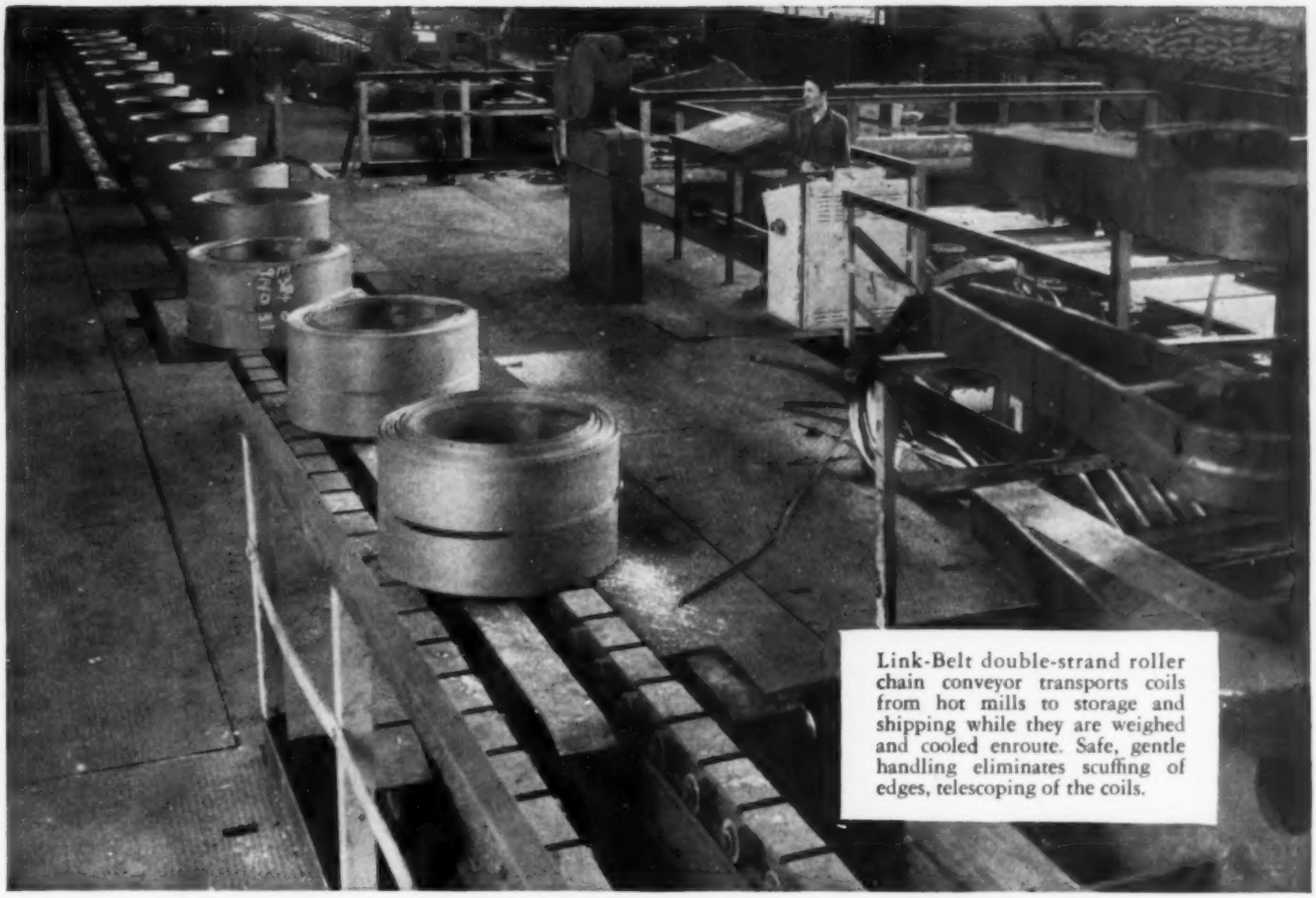
answers many questions that mean better production, more profit for you. Just look at the table of contents:

- Tank cleaning methods
- Machine cleaning methods
- Electrocleaning steel
- Electrocleaning nonferrous metals
- Pickling, deoxidizing, bright dipping
- Pre-paint treatment in machines, in tanks and by hand
- Paint-stripping
- Steam-detergent cleaning
- Barrel cleaning
- Burnishing
- Better cleaning in hard-water areas
- Treating water in paint spray booths
- Rust prevention
- Machining and grinding

FREE For this 44-page illustrated booklet, write Oakite Products, Inc., 19 Thames St., New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE



Link-Belt double-strand roller chain conveyor transports coils from hot mills to storage and shipping while they are weighed and cooled enroute. Safe, gentle handling eliminates scuffing of edges, telescoping of the coils.

MOVE up to 75,000 lb. COILS . . .

and get less scrap loss, greater safety

Yield goes up . . . waste goes down . . . with LINK-BELT Coil Handling Equipment

EVER-increasing rolling mill capacity and the trend toward larger coils require heavier conveyor systems capable of handling greater tonnages.

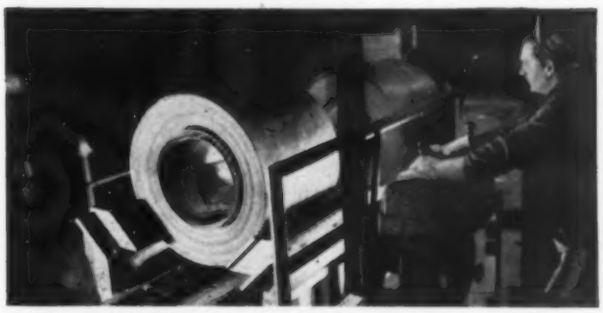
Since the inception of the continuous strip mill, Link-Belt has pioneered coil handling equipment. Now America's steel mills can choose from three basic Link-Belt conveyor types . . . designed to cover the complete range of operating needs.

Our engineers will work with your own engineers, consultants and builders of mill and process equipment. If you are contemplating expansion, it will pay you to call your nearest Link-Belt representative.

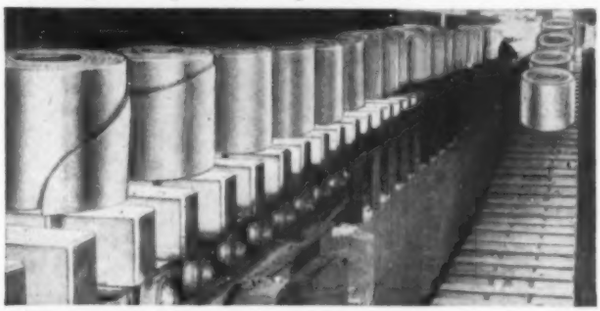
LINK-BELT

MATERIALS HANDLING, PROCESSING and POWER TRANSMISSION MACHINERY

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Cleveland 15, Pittsburgh 13, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Offices in principal cities. 12.417-R



Coils are lifted clear of the Link-Belt heavy-duty pallet conveyor for automatic weighing at entry end of continuous pickle line. Other Link-Belt conveyors are designed for handling coils up to 75,000 pounds each.



Where numerous turns are required or cooling space is limited, Link-Belt Car-Type Conveyors are best. Coil never leaves its car. Without rolling or scuffing of edges, coils go around corners, up and down inclines.

10-TON, 29′-1½″ SPAN
O. H. FLOOR CHARGER

BUILT BY MORGAN Engineering

DESIGNERS • MANUFACTURERS • CONTRACTORS

BLOOMING MILLS • PLATE MILLS • STRUCTURAL MILLS

ELECTRIC TRAVELING CRANES • CHARGING MACHINES

INGOT STRIPPING MACHINES • SOAKING PIT CRANES

ELECTRIC WELDED FABRICATION • LADLE CRANES

STEAM HAMMERS • STEAM HYDRAULIC FORGING PRESSES

SPECIAL MACHINERY FOR STEEL MILLS

THE MORGAN ENGINEERING CO.

ALLIANCE, OHIO PITTSBURGH—1420 OLIVER BUILDING

Illustrated is a Morgan 10-Ton High Visibility Floor Charger with hydraulic hoist and box clamp.

By using a hydraulic hoist, the large hoist motor with its reduction unit usually used, is eliminated, thus providing maximum visibility for the operator.

A hydraulically operated head at end of peel clamps the box head so the box will not "flop around" when turned.

Four (4) take-up reels for handling the motor leads are provided, thus eliminating twenty (20) conductor angles on the bridge.

Trolley is carried on four (4) top running wheels with two (2) kick-up wheels. The two rear upper and kick-up wheels are spring suspended for absorbing shocks when picking up loaded boxes.

Equipment News...

MILLION DOLLAR IDEA

▲ A paint foreman at Aluminum Co. of America's New Kensington, Pa., works has hatched an idea worth millions of dollars to American industry.

The nub of paint foreman R. W. Spence's idea is to cover industry's millions of miles of wire fence by pouring aluminum paint, or any other kind, instead of spraying or brushing.

The new method of wire fence painting cuts maintenance costs in half.

Painters at Alcoa's New Kensington works were the first to use the new paint method. Paint was poured from a two-gallon oil can with a flexible spout along the top portion of one section of the plant's wire fence. On both sides of the fence were suspended panels (5 ft × 5 ft) which acted as a trough and coursed the paint over the intertwined wire.

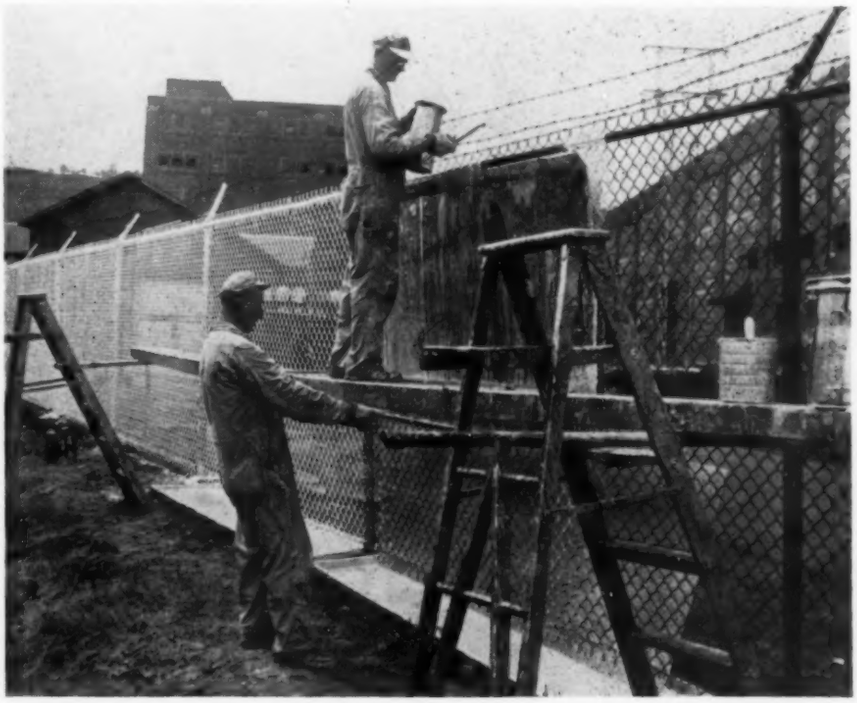
The panels are kept as closely as possible in contact with the fence. Some bracing may be necessary on warped or damaged fence.

The paint flows over the fence and drains into a catch pan (2 ft × 10 ft × 2 in.) for reuse. One catch pan remains under the section previously painted.

At the Alcoa plant, where no wire brushing was needed, one coat of red lead paint was poured and was followed by one coat of aluminum paint. The total cost including labor, burden and materials was 96 cents per foot for the two coat application. Immediately after the pouring operation one painter went over the work to cover any skips and to paint portions of the posts not already covered. This is the only hand brushing required.

Using Mr. Spence's method of painting, Alcoa paintmen covered 5-ft lengths of fence in four to five minutes.

A painter at Aluminum Co. of America's New Kensington, Pa., works pours, rather than brushes or sprays, aluminum paint on the company's wire fence. Panels fitted closely on each side of the fence guide the paint over the wire. As a result, coverage is better, faster and cheaper than by other methods used. Maintenance costs are cut 50 per cent. Immediately after pouring, one painter quickly brushes skips and portions of the posts not covered.



STEAM ENGINE REPLACED

▲ A modern electric drive will replace a famous old steam engine in operating the record-making Aliquippa, Pa., blooming mill of the Jones & Laughlin Steel Corp.

The 12,000-hp electric unit, now being built by the General Electric Co. at its Schenectady, N. Y., works, will be the nation's most powerful reversing mill drive for converting ingots into blooms. It will replace the 40-year-old steam giant that powered the mill to a world production record (183,728 tons rolled from five-ton ingots) during March, 1949.

The double armature twin reversing main drive for the 44-in mill will consist of two 6000-hp, double-armature motors, each driving one of the two work rolls. Operating on 750 volts, these d-c motors will have a speed range of 70 to 140 rpm.

Amplidyne control will provide near-instantaneous response in accelerating, decelerating and reversing. The motors will be capable of reversing at the 70-rpm "base" speed in approximately one second.

A 12,000-kw flywheel motor-generator set with liquid slip regulation will supply power to the motors. The m-g set will consist of a 9000-hp wound rotor induction motor; four 3000-kw, d-c generators, and a cast steel flywheel with a stored energy of 250,000 hp-seconds at 360 rpm. Nearly 16 feet in diameter, the flywheel will be more than two feet thick, and will weigh 91½ tons.

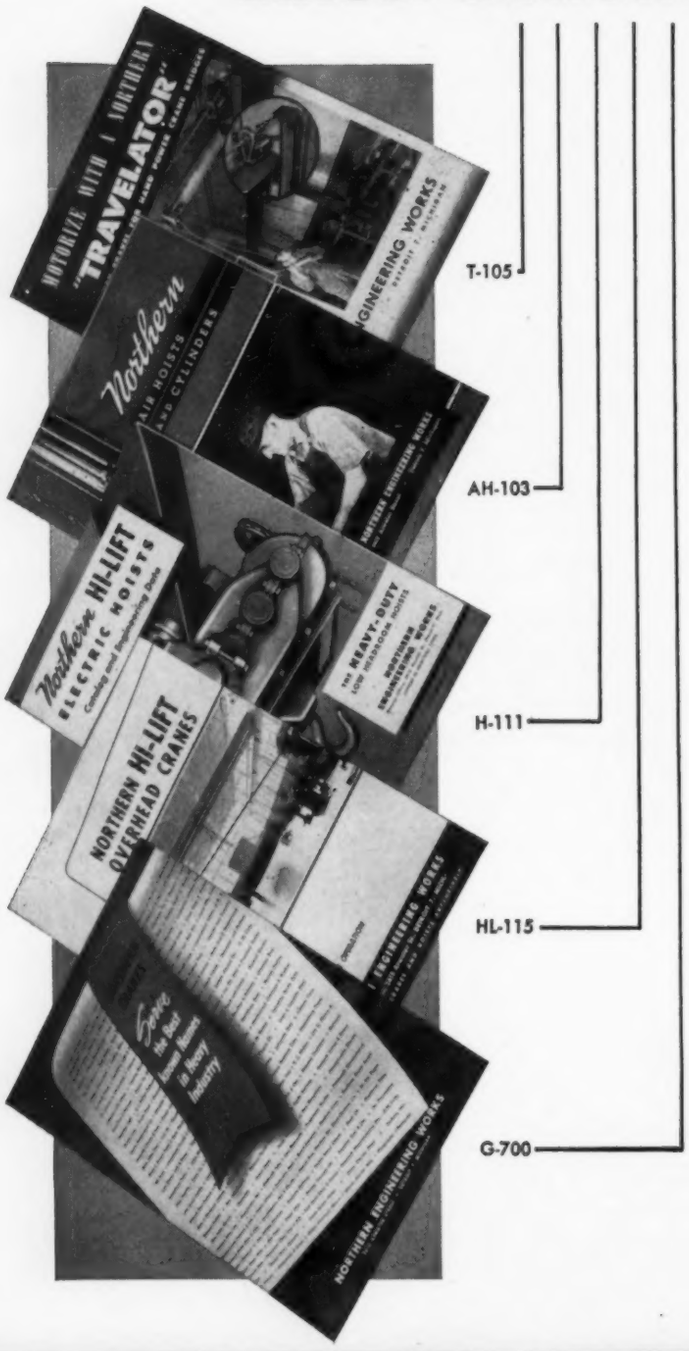
General Electric also will supply quantities of metal clad switchgear, a-c unit substations, ventilating equipment for the motors and generators, and m-g sets and controls for auxiliary drives.

Reflecting the importance of this blooming mill to a steel-hungry defense front, Jones & Laughlin has made extensive plans to insure against breakdown in the mill's 160-hours-a-week work schedule. The new electric drive will be so installed that the mill can deliver near-peak performance with any one of its four generators out of service. Stub-shafting will be provided so that any generator can be removed for repair while maintaining mechanical connection between the remaining three generators and the wound rotor motor. A complete armature assembly for the main drive motors will be stocked, and spare

for your file....

NORTHERN'S

Latest Bulletins



NORTHERN ENGINEERING WORKS

2615 ATWATER ST. DETROIT 7, MICHIGAN

exciter sets will be installed and ready to operate.

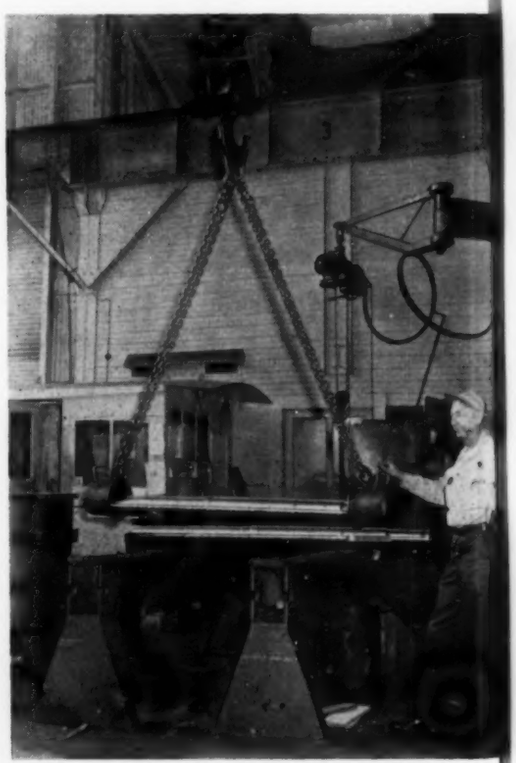
The changeover will begin next year with preliminary construction and installation of all components except the main drive motors. The motors will replace the steam engine some time in 1953.

BLAST CLEANING MACHINE

▲ Farrell-Cheek Steel Co., Sandusky, Ohio, reduces labor costs, speeds cleaning, improves job quality, and increases foundry output by cleaning carbon and steel-alloy castings with eight different blasting units. Each blast-cleaning machine handles specific casting types and sizes. The cleaning equipment includes one air-blast room, one centrifugal-blast turn-table machine, four 14 cu ft centrifugal-blast barrels, one 28 cu ft centrifugal-blast barrels, and one specially designed mass production machine.

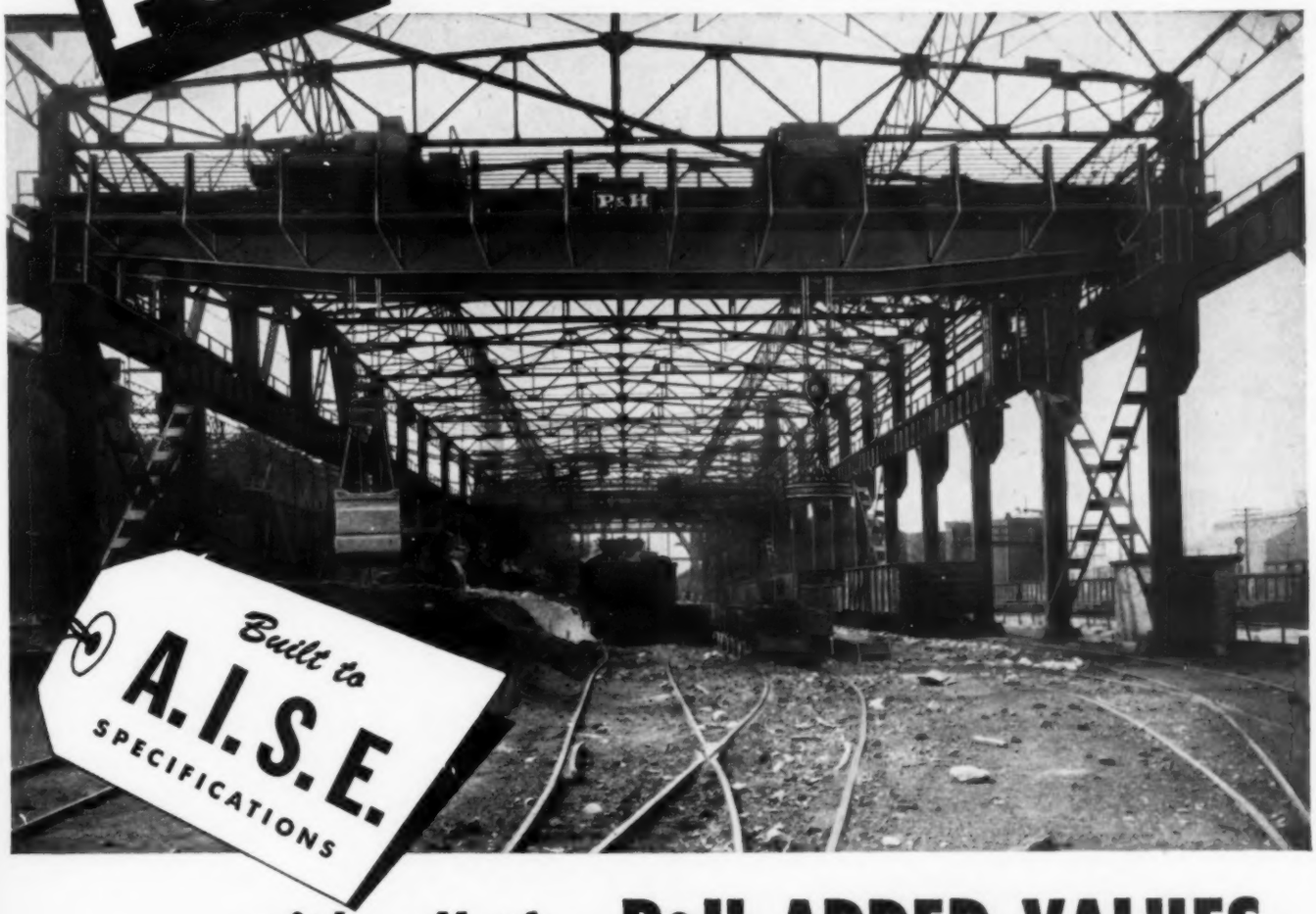
The newest cleaning equipment is the Rotoblast "Turn-style" table.

SHAFT MOVER



They do not drop shafts at the Torrance, Calif., plant of National Supply Co., manufacturers and distributors of oil field machinery and equipment. A short piece of pipe, capped on one end and with welded hook and handle, is placed over each end of a shaft prior to lifting. The open end of the pipe is flared to make positioning easier.

P&H MILL TYPE CRANES



. . . with all the P&H ADDED VALUES Steel Men want!

Three Gear Case Bridge Drive
delivers motive power to end trucks, perfectly equalized. Mill motor is connected to gear case at center of span, which transmits power equally to the gear cases in front of each end truck.

No Open Gears at Trucks—
gear reductions are completely enclosed in sturdy all-welded cases. All gears run in oil — quietness and long life are insured with all gears operating in oil baths. No exposed gears; no dripping grease.

Flexible Couplings at Wheel Shafts
assure smoother starts — maximum bearing life and prevent thrust from entering gear cases.

Split Gear Cases
are designed to simplify inspection and maintenance.

Large Diameter Cross Shaft
combines maximum strength with low torque to minimize strain.

Hoist Sheaves
readily accessible from trolley deck. All hoist gears, including drum gear and pinion, run in oil.

Trolley Frame
and bridge ends are line bored and milled.

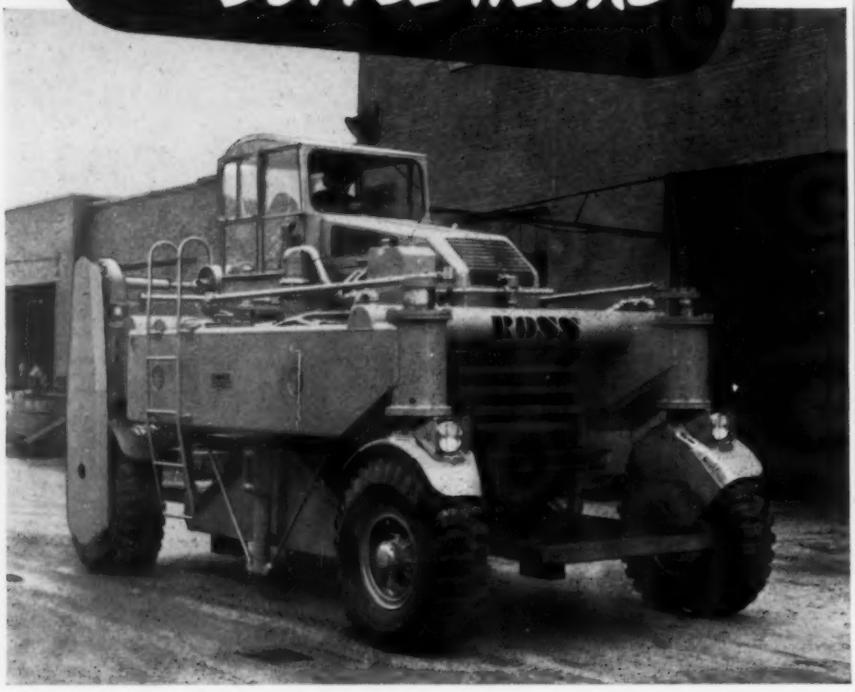
P&H Motors,
brakes and controls are available.

These and many other Added Values explain the preference which accounts for more than 2,000 P&H Cranes in steel mills. P&H Mill Type Cranes are described in Bulletin C-42. Ask for your copy.

P&H **OVERHEAD CRANES**
4455 West National Avenue
Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

POWER SHOVELS • CRAWLER AND TRUCK CRANES • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • DIESEL ENGINES • PRE-FAB HOMES

ELIMINATE STEEL HANDLING BOTTLE NECKS



ROSS Series 100 CARRIER

...simplest mass handling method known!

Now... you can move 45,000-pound payloads of billets, bars, plate, in-process and finished steel *where* you want them *when* you want them... at a moment's notice!

Now... you can be free of the restrictions of a plant railroad handling system... its expensive trackage, cars, locomotives... costly, time-consuming switching operations!

Now... you can prevent congestion in the mill... free more mill space for production operations... eliminate costly re-handling ... save time and money in getting out current orders!

How? With Ross Series 100... the *only* Carriers designed and built all the way through for rough, tough steel mill service... the *only* Carriers with that great reserve strength steel men demand. Self-loading and unloading, Ross Series 100 requires only a driver... and moves capacity loads at speeds up to 33 mph.

Don't overlook the outstanding advantages of the Ross Carrier Steel Handling Method... ASK STEEL MEN WHO *KNOW!* Get full details on Ross Series 100 Carrier... a 'phone call, wire or letter will do it.

Rely On ROSS

THE ROSS CARRIER COMPANY

Direct Factory Branches and Distributors Throughout the World

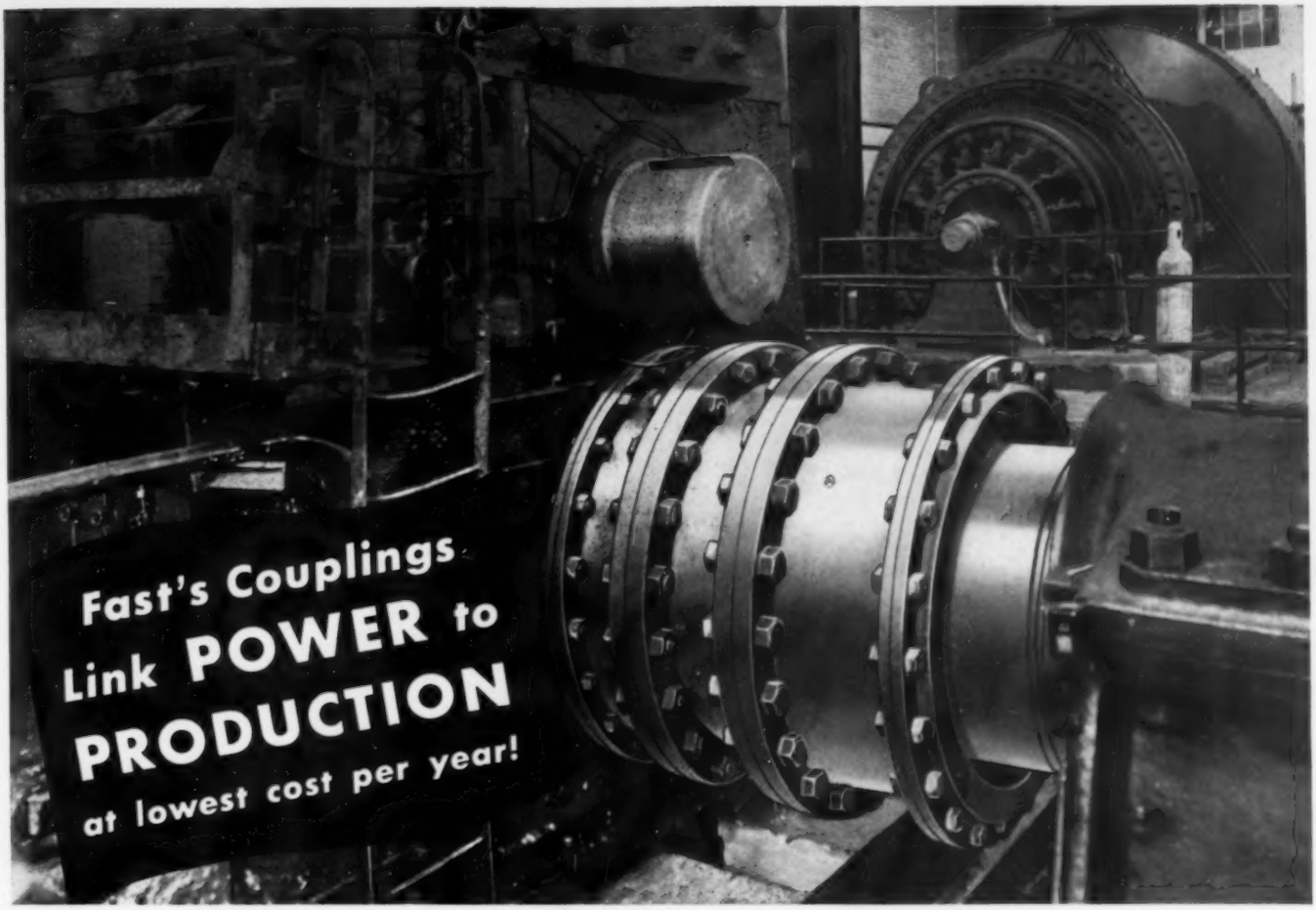
400 Miller St., Benton Harbor, Michigan, U.S.A.

The rotation of the cleaning-room door by the operator places the "Turn-style" table of unblasted castings in the cleaning room and simultaneously brings out the second rotary table containing the cleaned castings. With this arrangement, blasting and table loading are accomplished at the same time.

This machine is used to blast large castings up to 6½ ft long, 5 ft high and 1500 lb. The abrasive is hurled against the work by centrifugal force as the work is passed under the abrasive-throwing "wheel." Work is placed on tables attached to each side of the door of the cleaning room. The door turns about a center axis in such a manner that the operator loads one table with up to 1.5 tons of castings while the other table is inside the room under the cleaning stream. With this unique arrangement the cleaning machine bombards castings 85 per cent of the time, being stopped only to turn the door. Green work is blasted eight minutes and annealed castings twelve. The machine averages 40 to 50 loads per 8-hour day and by eliminating older hand cleaning methods has cut labor costs by 22 per cent, or $8.50 per day.

The Pangborn airblast room is used to clean extra-large steel castings. Work is wheeled into the room on a rail-car and the operator, wearing protective clothing, directs with a hose a stream of air-driven abrasives against the work. Because of high production cleaning of king-size castings by the "Turn-style" table, only thirty to forty tons of steel castings per month are still cleaned in this room.

The 28-cu-ft-capacity rocker barrel blasts large steel castings of sizes and shapes suitable for tumbling. The operator puts as much as 2000 lb of castings in the barrel and pushes the starting button. Centrifugally thrown abrasives are directed toward the center of the barrel as the barrel rocks, rolling the castings under the stream and turning them to make



FAST'S Couplings usually outlast the equipment they connect!

ACTUAL cases on record show many Fast's Couplings are still in service after as much as 30 years of continuous operation! Time and time again, equipment has been replaced while the original Fast's Couplings remained on the job.

To you, these records of dependable, trouble-free service mean freedom from costly coupling failures when you specify Fast's. And they mean Fast's cost you far less to own and operate . . . because their cost can be amortized over long years of dependable performance.

For full details on how Fast's Couplings and Koppers Engineering Service can help you, write today for a free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* 212 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS

FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.,*
212 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name.....

Company.....

Address.....

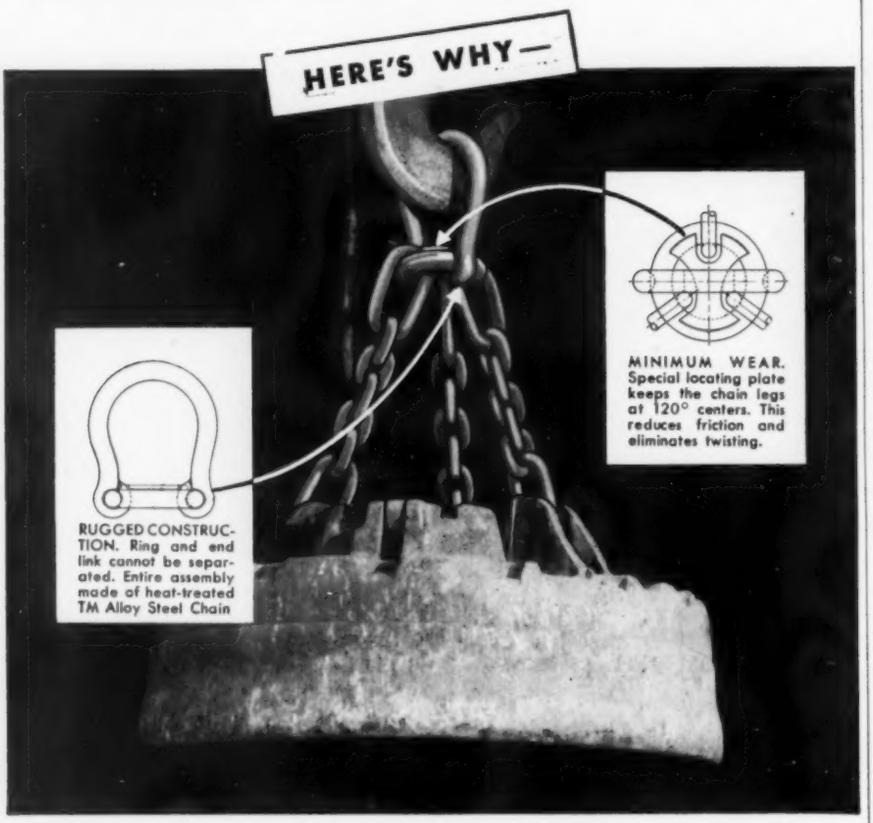
City..... *Zone*..... *State*.....

TM Alloy Steel Downtown

Frictionless
MAGNET CHAINS

DO MORE WORK, LAST LONGER,

COST LESS than conventional types!


HERE'S WHY—
MINIMUM WEAR. Special locating plate keeps the chain legs at 120° centers. This reduces friction and eliminates twisting.
RUGGED CONSTRUCTION. Ring and end link cannot be separated. Entire assembly made of heat-treated TM Alloy Steel Chain

Extensive on-the-job tests prove TM Alloy Steel Downtown Magnet Chains superior to any other three-leg assemblies on the market. Patented design of end link and horizontal ring with special locating plate keep chain legs at 120° centers. This prevents ganging-up, excessive friction and twisting . . . assures level lifts and even distribution of load weights. Additional long life, safety and economy is assured by Heat-Treated TM Alloy Steel Construction. High tensile strength, great resistance to abrasion, grain growth and shock at sub-zero temperatures are only a few of the TM Alloy Steel qualities. Send coupon today for details!

S. G. TAYLOR CHAIN COMPANY, Hammond, Indiana

S. G. TAYLOR CHAIN COMPANY
Dept. 75 Hammond, Indiana
Rush literature and prices on TM Alloy Steel Downtown Magnet Chains.

NAME _____

ADDRESS _____

TAYLOR MADE
A GREAT NAME IN
Chain SINCE 1873

sure that abrasives bombard all surfaces. This machine cleans 500 tons of green work and 250 tons of annealed castings per month. Castings range from 40 to 600 lb in weight. One man operates the Rotoblast barrel and increased production per work-hour over the airblast method saves more than $144 per week.

Four 14-cu-ft-capacity rocker barrels, using the same principle as the large one, clean the smaller castings. Two barrels clean green castings and two clean annealed castings. About 95 one-thousand-pound loads of green castings are cleaned per day. Each load is blasted for approximately eight minutes. Castings range from a few ounces to 40 lb. In the annealing department castings are blasted in loads of 1200 to 1400 lb for 12 to 14 minutes. These two Rotoblast barrels replace 5 tumbling mills which were unable to keep up with Farrel-Cheek's increased production.

The eighth machine is a special cabinet designed for a particular need — to clean the complex surfaces of screw conveyors used on coal stokers. High production rates (up to 200,000 per year) justified a custom-built machine in this case and a special device was designed to carry the screw conveyors into the cabinet, expose all surfaces to the blast stream, and deliver them perfectly clean.

SYNCHRONOUS MOTOR

▲ A new small synchronous motor with unusual operating characteristics has been announced by Allis-Chalmers Manufacturing Co.

The motor, operating on the reluctance principle, has no brushes, slip rings, rotating coils or permanent magnet. It can be built to operate continuously at any voltage below 250 volts, either single phase or polyphase, and should interest designers of control systems, instrumentation, and military and industrial equipment.

A typical motor is 4 in. in diameter by 2⅜ in. long, weighs 2.6 lb, and develops 8 oz-in. starting torque and 0.8 in. synchronous torque. Simplicity of construction provides high stock resistance and practically no maintenance.

No starting equipment is required, the motor being able to start and pull into step at any frequency from 10 to 400 cycles.

Publication Service...

FEBRUARY, 1952

You Can Obtain...

... any of the bulletins reviewed in the Publication Service of the IRON AND STEEL ENGINEER without obligation or cost. Simply circle the desired item numbers on one of the prepaid postal cards and mail. The requests will be forwarded to the manufacturers involved who will send the bulletins to you.

(1) Blending

A new bulletin on the subject of blending has recently been issued. This 16-page booklet supplies a thorough exploration of blending, as indicated by its chapter headings: What is Blending, Advantages of Blending, Principles of Blending, Mixing, Proportioning, Evaluation. Then follows a comparison of methods of blending in which bin blending is described and contrasted with the Hewitt-Robins blending system as performed with such equipment as an ore reclaimer, a coal reclaimer or a digging reclaimer. Concluding chapters cover the subjects of blending for the blast furnace, blending for the copper smelter, blending for raw material conservation and blending for general industry. (152) Robins Engineers Division, Hewitt-Robins, Inc.

(2) Hydraulic Setting Refractories

A new 12-page brochure entitled, "Hydraulic Setting Refractories," is available. The booklet presents the five different "Firecrete" products for casting special refractory shapes and the three "Blazecrete" products for gunning and slap troweling applications. These are hydraulic-setting refractories for services through 3000 F. The brochure contains suggestions for solving maintenance problems as well as recommendations for casting shapes and linings. Photographs show typical uses and illustrate handling methods. The text includes descriptive information and tables giving pertinent data. (RC-28A) Johns-Manville.

(3) Fan Cooled Motor

Construction features and details of Allis-Chalmers totally-enclosed, fan-cooled motors with tube-type, air-to-air heat exchangers in ratings from 40 hp at 600 rpm through 800 hp at 3600 rpm are described in a new bulletin just released. The bulletin points out that the motors are available in standard and explosion-proof designs. The former are for applications without explosion hazards but requiring protection of the windings from dust, dirt, acid fumes, etc. Explosion-proof machines are available, with Underwriters' labels, for atmospheres with flammable gases presenting no greater hazard than high test gasoline vapor and air mixture, and for atmospheres with such combustible dust as carbon black, coal, coke, or grain. (51B7149B) Allis-Chalmers Manufacturing Co.

(4) Temperature Controls

A new 52-page catalog on Thermoswitch temperature controls has just been published. The catalog describes the design, operating characteristics and installation of each of the 10 variations on the basic Fenwal thermostatic device. A special section concerning the selection and application of the "Thermoswitch" discusses such subjects as operating differential, sensitivity, temperature variation, lag and overshoot, characteristics of heat sources, frequency of switching and installation in solids, liquids and gases. Illustrated with many helpful drawings, photos, graphs and tables, other sections cover: principles of the basic "Thermoswitch" and why it is sensitive only to heat; modifications, special features, protective wells and the Fenwal temperature test kit. Dimensional drawings and thermal and electrical specifications are given for both the standard and heavy-duty types of each model. In addition, typical applications of each model are described and illustrated. (400) Fenwal, Inc.

(5) Permanent Magnets

A complete listing of stocked sizes and shapes of Carboloy Alnico permanent magnets is included in a bulletin now available. The 20-page catalog contains pull curve and size information in tabular form on stocked types of Alnico permanent magnets, both cast and sintered, as well as size and application data on stocked holding assemblies, including sheet steel separators, magnetic retrievers and magnetic stands. A list of available patterns for various sizes of cast Alnico bars, blocks, rods, rings and sleeves is included. The catalog also describes three types of Carboloy permanent magnet magnetizers. Tables of properties and tolerances in addition to ordering information and conversion tables are included to aid in applying and purchasing Alnico permanent magnets from stock. (PM100) Carboloy Department, General Electric Co.

(6) Roll Marker

A technical bulletin covering an improved Model "C" automatic roll marker for screw machines has been issued. The simple manner in which the roll marker can be used to eliminate secondary operations, improve marking clarity, and reduce costs is described and illustrated, including instructions for operation, setup, use of offset dies, correct locating of starting pad, ordering markers or dies, etc. New Method Steel Stamps, Inc.

(7) Air Mover

An improved device for moving large volumes of air quickly and economically in situations requiring intermittent or emergency ventilation, is described in a new four-page bulletin just published. Portable and light-weight, the instrument is adaptable for use in industrial plants, mines and wherever else circumstances make it necessary to remove air contaminants from confined areas or to introduce fresh air for safe ventilation or rapid cooling. The bulletin gives examples of its use in oil refineries, chemical companies, steel plants, utility companies, steamship lines, air lines, mining operations and others. Called the "M.S.A.-Lamb Air-Mover," the versatile device employs compressed air or steam in its principle of operation. Horn

shaped, with a bell-formed base, the air-mover converts pressure of compressed air or steam from any supply source into a large induced volume of moving air. The steam or compressed air is fed through a side inlet at the bell end. Expanded at high velocity it is discharged through the outlet horn, drawing with it a large volume of the atmosphere to be moved. (DP-5) Mine Safety Appliances Co.

(8) Wire Rope Assemblies

A new catalog is available that lists wire rope assemblies for machine parts and operating devices. Called, "Macwhyte Safe-Lock Industrial Standards Wire Rope Assemblies," this new catalog illustrates and gives detailed specifications for wire rope with fittings permanently attached. Assemblies are used, for operating controls, as a part of machinery and equipment, and for slings and hoists. (5201) Macwhyte Co.

(9) Flow Meters

A new 40-page bulletin describing a line of flow meters has just been published. The bulletin describes instruments for recording, integrating, indicating, automatic controlling, and telemetering the flow of steam, water, air, gas, oil, solutions, and other fluids. Both mechanical and electric type flow meters are described in a full range of models suitable for a wide variety of uses in industrial plants, utility companies, and process control work. Complete information is given on the various types of meter bodies, operating principles, primary devices for flow measurement, recording charts, and accessories. In addition to numerous photographs, the bulletin is liberally illustrated with reproductions of actual recording charts, and sketches of typical methods of applying the instruments. (F1605) Bristol Co.

(10) Oscillating Conveyors

A new 24-page book on positive action oscillating conveyors for conveying, feeding, cooling, screening a great variety of loose bulk materials, is available. The book includes dimensions, weights, and capacity and horsepower charts on torsion mount oscillators for heavy duty as well as for the recently announced "Flexmount" oscillator for the lighter-duty applications. In these machines, a clear, continuous, one-piece metal trough mounted on resilient supports is given an upward and forward oscillating motion by a constant-stroke eccentric drive, thus providing a powerful, yet gentle action that moves large volumes of material ahead in a uniform, continuous flow. The book shows the handling of shakeout sand, food products, cement clinker, metal chips, hot mineral sands, hot castings, silicon carbide and cullet. Among other bulk materials listed are coal, ores, chemicals, wood chips, etc. The trough widths of standard conveyors range from 8 to 48 in., and the handling capacities range from a few pounds to several hundred tons per hour. (2444) Link-Belt Co.

(11) Carbon and Graphite Brick

A revised catalog section covering "National" carbon and graphite brick, for application in the chemical, processing and metallurgical industries has been announced. The catalog lists the principal features of carbon, graphite and impervious graphite, and some typical metallurgical and chemical applications. Complete tables are given for brick sizes, shapes, grades and physical properties, with special information on graphite beams, blocks, plates and rods in sizes up to a maximum of 24 in. x 30 in. x 180 in. Suitable cements are available for use with both the regular grades and the impervious types of carbon and graphite brick, including scored carbon brick in applications requiring maximum strength of bond. To meet the need for an impervious, corrosion-resistant material, "Karbate" brand impervious carbon and graphite in the standard brick shapes and sizes are shown in convenient tables. (S-6210) National Carbon Co., Division of Union Carbide and Carbon Corp.

(12) Control Thermometer

A specification sheet is available describing Honeywell's "Electr-O-Vane" control thermometer, having snap action electronic control. The sheet consists of four pages and gives a comprehensive resume of the models available. (609) Minneapolis-Honeywell Regulator Co., Brown Instruments Division.

(13) Standardized Mill Motor Brushes

Anticipating wide-spread acceptance of the Association of Iron and Steel Engineers' standards for mill motor brushes, National Carbon Co. has ready for immediate distribution a new catalog section listing the complete line of "National" mill motor brushes built to conform to AISE standard specifications in every particular. The catalog lists all of the AISE standard numbers and code numbers, the corresponding "National" brush numbers, brush sizes, grades and cost. "National" Grades AX-5 and 401 are applicable to such a wide range of operating conditions that only one or the other of these two grades need be used for the several mill motor types to which each brush size applies. Both grades have a long and outstanding record of success on mill type motors, unsurpassed among all brush grades. Each brush is designed to give maximum performance on the particular motors specified by the AISE standard, and each brush is designed to sell for the lowest possible price. Shunt connections are a rugged, low-resistance, vibration-proof, tamped type. Many of the brushes are shipped from stock and the remainder are set up for quick fabrication in our factory. The five most popular items are available as "National" standardized brushes at the same low standard package price for 100 as for 100,000 brushes. (B-0635) National Carbon Co., Division of Union Carbide and Carbon Corp.

(14) Induction Heating

The technical story of low-frequency (60-cycle) induction heating is explained in non-technical style in a booklet available to you. The 20-page booklet features semi-cartoon illustrations of the specific phases of induction heating. Magnethermic Corp.

(15) Crane Trucks

A bulletin has been issued describing locomotive type crane trucks. Model CXB has a rated capacity of 6000 lb at 7-ft radius. Model CXF's rated capacity is 10,000 lb at 5½-ft radius. The new six-page bulletin uses cutaway photos of component parts to make construction details easy to follow. Complete engineering specifications and drawings are also included, along with action photographs that show these trucks at work in a variety of applications. (1613) Baker Industrial Truck Division, Baker-Raulang Co.

(16) Tap Changing Equipment

A new catalog entitled "Pennsylvania Underload Tap Changing Equipment" has just been published. The catalog covers underload tap changing equipment for

single-circuit unit substations in all sizes and all voltages; step voltage regulators, three-phase, in voltages up to 750 kva; and load ratio control transformers in all voltages up to 7500 kva. The tap changing equipment and controls are illustrated and fully explained in the 16-page booklet. One of the important items discussed in the catalog is Pennsylvania's "Silent Snap" switch. This is an outstanding new switch which moves swiftly and noiselessly, responding to the demands of automatic controls—raising or lowering voltages in comparative silence. The design of the silent snap switch will result in: 1. less wear and tear on the equipment; 2. no breakdowns from mechanical impact; and, 3. longer and more satisfactory tap changer life. (5112) Pennsylvania Transformer Co.

(17) Precision Instruments

Advanced type slack tube manometers, magnehelic gages, "Visi-Float" air filter gages, hook gages and smoke gages engineered for utmost sensitivity and accuracy are highlighted in a new catalog recently issued. These are new additions to the company's complete and long established line of portable and stationary gages for measuring positive or differential pressure, vacuum, velocity, flow or temperature of gases in laboratory, factory or field work. F. W. Dwyer Mfg. Co.

(18) Sprockets

Just published is a 12-page catalog devoted to a line of cast steel sprockets. The merits and uses of the various Farrell-Cheek Steels are described, and complete specifications are supplied for an extremely large range of sprockets. Farrell-Cheek Steel Co.

(19) Arc Furnace Electrical Equipment

A new 20-page booklet describing electrical equipment for arc furnaces is available. The booklet discusses application of electrical equipment to both direct and submerged arc furnaces, for applications in steel mills, chemical plants, foundries, and nonferrous metal refineries. According to the booklet, proper selection and application of electrical equipment can keep power and maintenance costs down, and output high. Electrical equipment described, in addition to "Optimelt" arc furnace control, includes circuit breakers, transformers, furnace regulators, and control panels. (B-4695) Westinghouse Electric Corp.

(20) Outdoor Switches

Onew 6 page illustrated bulletin (514) describes a ne w hook operated disconnecting switches with an improved arrangement of high pressure silver to copper contacts, a new hard drawn copper tubular blade and an over-all design providing superior electrical and mechanical characteristics. Complete technical data is furnished in tabular form. (5104). Delta-Star Electric Co.

(21) For Maintenance Men

New, colorful, quick reference folder, describing electrical and lubricating products that can make maintenance dollars do double duty is available. Briefly describes merits of powder-packed renewable, one-time and plug fuses, fuse pullers, "Kliplok" clamps for fuse clips, "Kliplok" test clamps and lubricating devices. The lubricating devices are segregated into a handy wall chart showing various types and sizes, together with suggestions for proper selection and application. Photos of actual installations are also shown. Trico Fuse Mfg. Co.

(22) Sheet Lifters

A very complete catalog is available describing lifters in standard or semi-special models that will solve more materials handling problems because they provide an economical, efficient and more flexible method of handling materials and equipment. The booklet contains various installation photographs and data, as well as dimensions and other specifications. Every rolling mill supervisor should have this booklet in his file for reference. Cullen Friestedt Co.

(23) Hardfacing Wall Chart

A new wall chart which details the proper hardfacing rod for the job has been released. The chart divides welding into basic operations, under which are listed the equipment parts to be "Amscoated" together with the recommended rod, available sizes, and preferred method of application. A fuller description of the uses of each rod also appears on the chart. The result is an easily read, thorough, and conveniently located reference guide. The chart is 17 x 26 in. with tabs attached for easy hanging and has a lacquered surface to keep it readable under shop conditions. American Manganese Steel Division, American Brake Shoe Co.

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ITEM	COMPANY	BULLETIN	DESCRIPTION
50	ALDRICH PUMP CO.	DATA SHEET 61-2	Facts on Aldrich spray nozzles.
51	AMERICAN AIR FILTER CO., INC.	BULLETIN 250-E	Engineering data on air filters.
52	AMERICAN CHEMICAL PAINT CO.		Descriptive folder available on "Rodine."
53	AMERICAN MANGANESE STEEL DIVISION AMERICAN BRAKE SHOE CO.		Catalog obtainable on dollar-saving Amsco electrodes.
54	BLISS CO., E. W.		52-page rolling mill brochure.
55	BROWNING AND CO., INC., VICTOR R.	BULLETIN "E"	Describes Browning mill type cranes.
56	COLUMBIA ELECTRIC MFG. CO.		Descriptive bulletins available on Columbia motor generators.
57	CUNNINGHAM CO., M. E.	BULLETIN J-547	Gives complete data on the "Safety" tag embossing and tagging outfit.
58	CUTLER-HAMMER, INC.	PUBLICATION BR-2	Gives full facts on the Type M brake.
59	ELECTRIC SERVICE MFG. CO.		Illustrated folder available on Keystone electrical products.
60	ELLIOTT CO.		Full details available on Elliott motor design.
61	FARREL-BIRMINGHAM CO., INC.		Bulletins available giving complete specifications on Farrell roll grinders.
62	FOOTE BROS. GEAR AND MACHINE CORP.	BULLETIN LPC	Contains complete information on Line-O-Power drives and base plates.
63	GENERAL ELECTRIC CO.	BULLETIN GEA-4654	Gives information on G-E MD-600 mill motors.
64	HARNISCHFEGER CORP.	BULLETIN C-42	Describes P&H mill type cranes.
65	INDUSTRIAL GEAR MFG. CO.	BULLETIN 151	Gives full details on the increased service at the Industrial Gear plant.
66	JOY MANUFACTURING CO.		Literature available on electrical plugs and receptacles.
67	KOPPERS CO., INC., FAST'S COUPLING DEPARTMENT.		Fast's catalog available giving detailed descriptions, engineering drawings, capacity tables and photographs.
68	MACKINTOSH-HEMPHILL CO.	BULLETIN S-7265	Describes in detail the Mackintosh-Hemphill rotary straightener.
69	MARVEL ENGINEERING CO.	CATALOG 105	Complete engineering data on Marvel synclinal filters.
70	MATHEWS CONVEYER CO.	CATALOG 151	Describes Mathews roller and wheel conveyers.
71	MEDART CO.		Catalogs available on Medart equipment.
72	MINNEAPOLIS-HONEYWELL REGULATOR CO., INDUSTRIAL DIVISION		"Tomorrow is Today" gives a brief description of the manifold contributions of instruments to industrial processing.
73	NORTHERN ENGINEERING WORKS	BULLETINS T-105, AH103, H-111, HL-115 AND G-700	Northern's latest bulletins available on their equipment.
74	OAKITE PRODUCTS, INC.		44-page illustrated booklet available on "Some Good Things to Know About Metal Cleaning."
75	OKONITE CO.	BULLETIN IS-1053	Describes in detail Okolite-Okoprene cables.
76	POOLE FOUNDRY AND MACHINE CO.		Catalog obtainable on flexible couplings.
77	POST-GLOVER ELECTRIC CO.	BULLETIN 500	Detailed information on P-G steel grid resistors.
78	PYLE-NATIONAL CO.	CATALOG 2100	Complete description of Pyle-National's extensive line of heavy duty floodlights.
79	RELIANCE ELECTRIC AND ENGINEERING CO.	BULLETIN C-2001	Construction features, mechanical designs and selection data on Reliance "T" d-c motors.
80	ROBERTS AND SCHAEFER CO.		Illustrated data on plants available.
81	RUST-OLEUM CORP.		Complete literature available on stopping rust.
82	SPRAYING SYSTEMS CO.	CATALOG 22 AND DATA SHEET 3997	Complete information on the Spraying Systems descaling nozzle.
83	STANDARD CARBON CO.		Catalog available on Standard Carbon products.
84	STEARNS MAGNETIC, INC.	BULLETIN 604-F AND BULLETIN 226	Bulletins available on Stearns' magnetic brakes and clutches.
85	TAYLOR SONS CO., CHAS.	BULLETINS 314 AND 315	Complete data on Tasil brick and cement.
86	TAYLOR CHAIN CO., S. G.		Literature and prices available on TM alloy steel downtown magnet chains.
87	TIDE WATER ASSOCIATED OIL CO.		Bulletin available on "Tide Water Associated Lubricania."
88	TRUFLO FAN CO.		Illustrated literature available on Truflo fans.
89	UNITED STATES GRAPHITE CO.		40-page catalog available giving complete information on standard USG grades.
90	WALDRON CORP., JOHN		Helpful folder available explaining coupling features.
91	WILSON ENGINEERING CO., INC., LEE		Fully illustrated booklet available on single-stack portable base furnaces.
92	YORK ENGINEERING AND CONSTRUCTION CO.		Brochure available on York facilities.

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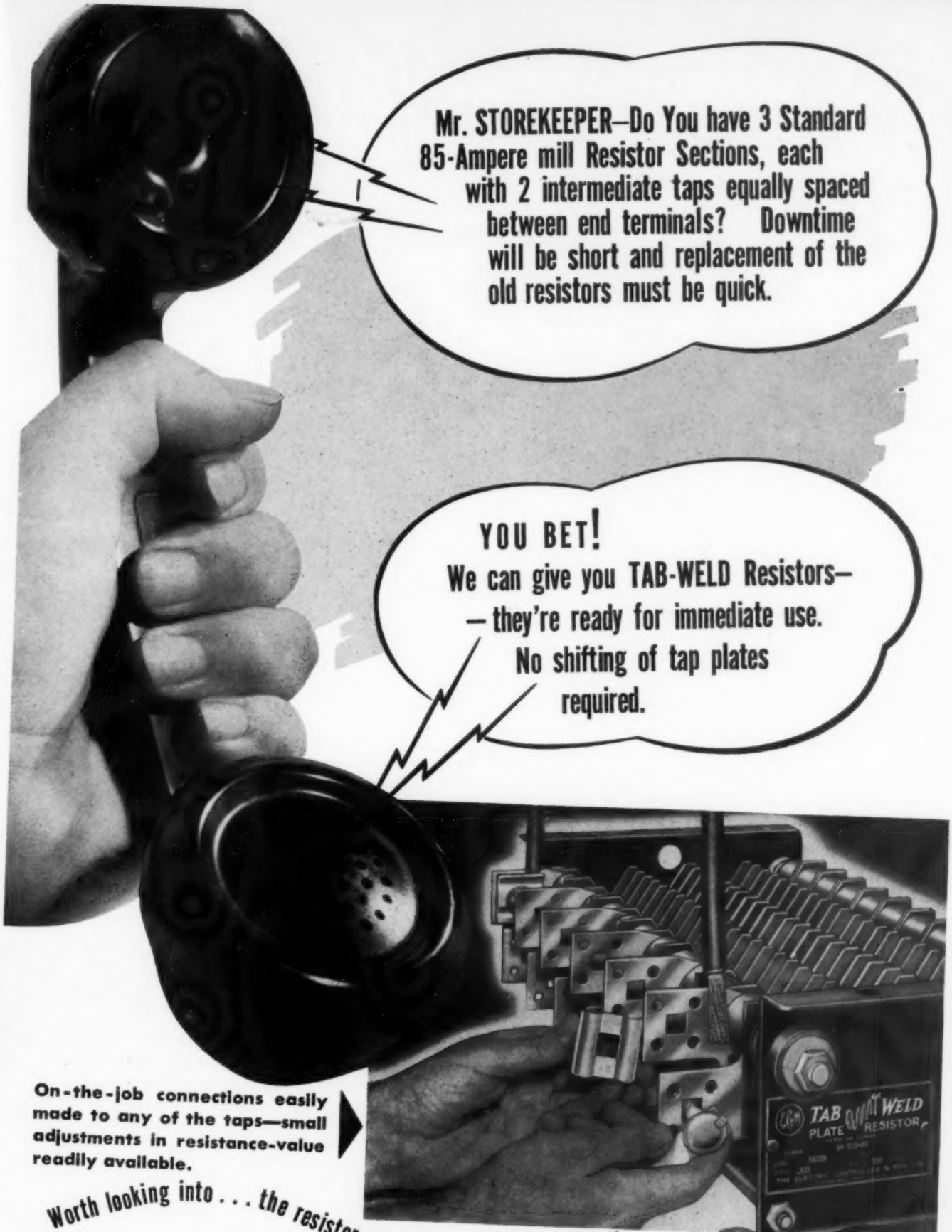
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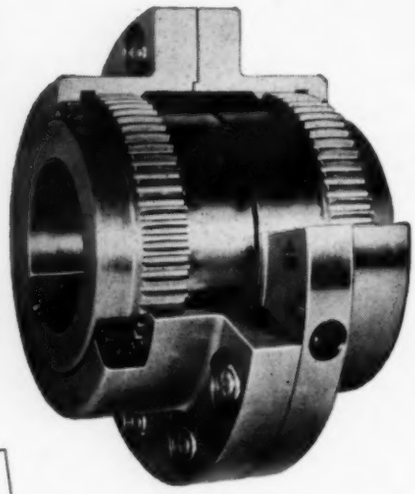

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Book Reviews . . .

▲ **"Pile Foundations, Theory–Design–Practice,"** by Robert D. Chellis has recently been issued by the McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y., 681 pp, 6 × 9 in., price $12.50. This is an unusually outstanding book which provides necessary facts and data which is needed for economical and efficient design and handling of pile foundations. Covered in the book are the principles of soil mechanics, methods of determining pile capacities from driving resistances, and methods for choosing for right piles and types of equipment. Data is given which describes and evaluates types of wood, concrete, steel and sheet piling.

▲ **"Elements of Physical Metallurgy,"** by Albert G. Guy has just been published by Addison-Wesley Press, Inc., Cambridge 42, Mass. This book contains 293 pp, 9¾ × 7½ in., price $6.50, and is a unit in the Addison-Wesley metallurgy series being primarily a text book for courses in fundamentals of physical metallurgy. The book is excellently and clearly written. It covers a number of background subjects and is followed by a discussion on the structure of metals and alloys. There is a complete section on equilibrium diagrams and phase structure. The latter part of the book emphasizes the properties of metals and alloys. It also has a good section on heat treatment as well as reactions in metals. The book should be of value to both the student and the user of metals.

▲ **"Buckling Strength of Metal Structures,"** a new book by the late Frederick Bleich, presents the behavior of fabricated steel structures under compression loading. This volume is one of the Series of Engineering Societies' Monographs produced under the sponsorship of the ASCE, ASME, AIME and the AIEE. The book has tables and simplified, approximate formulae and methods for design engineers, which also extend the theories of elastic buckling into the inelastic range. In so doing, the work covers the latest methods for analyzing the stability of high-strength alloys used in a wide range of structures and in ships' hulls. The book contains 508 pp, 6 × 9 in., 263 ill., and is priced at $10.00. It may be obtained from McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y.

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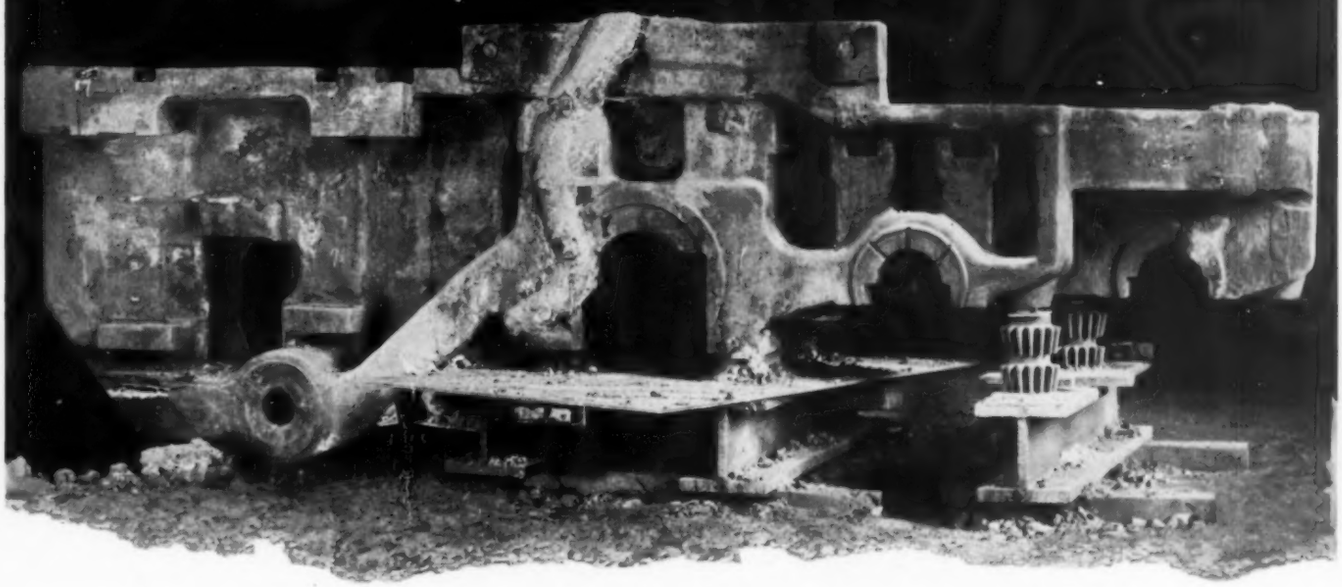

Shortly before this big blooming mill shear housing went down its owners, realizing the equipment was operating on borrowed time, contemplated replacement. Unfortunately the housing cracked wide open before the order was placed and important production was threatened.

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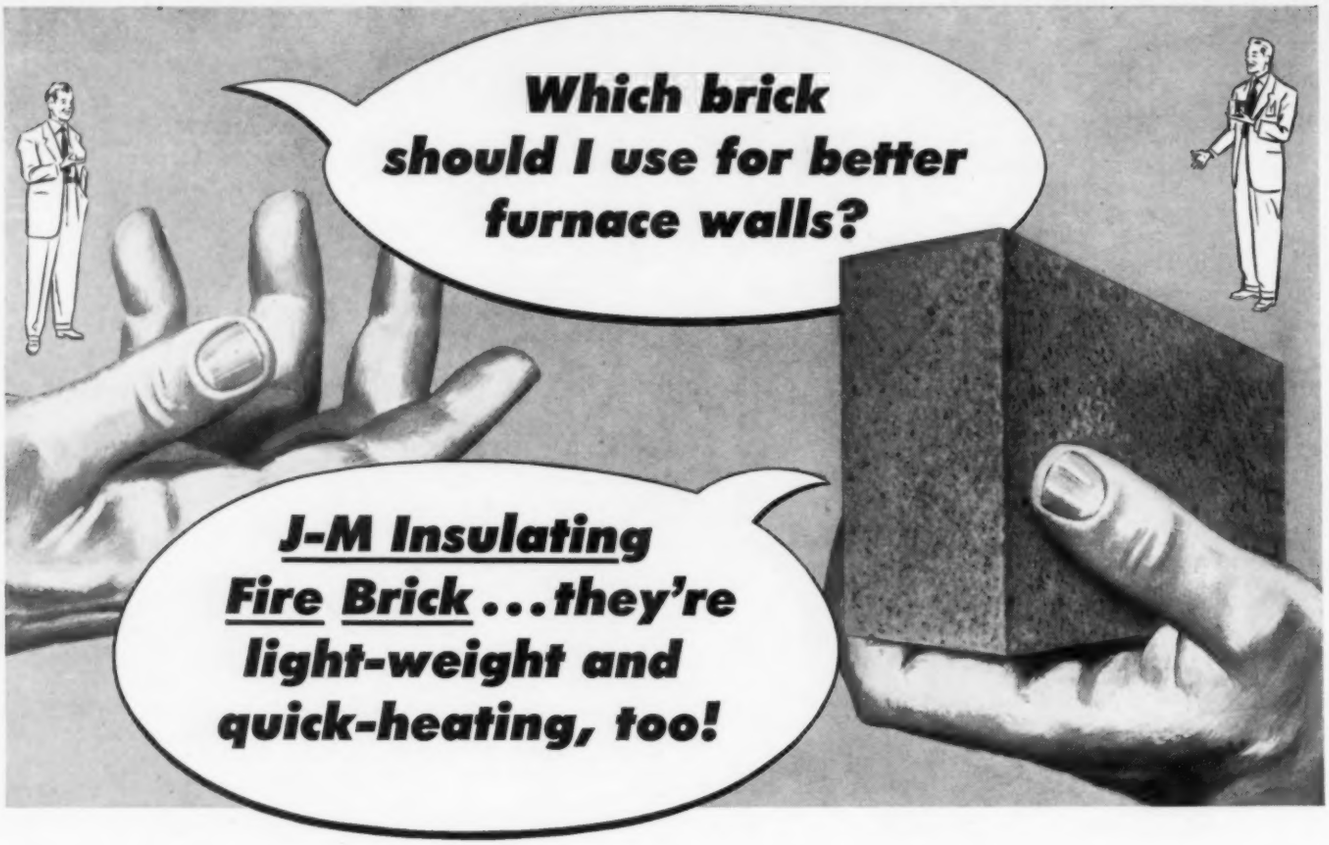

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Properties	Types of Insulating Fire Brick and Fireblok					
	JM-3000	JM-28	JM-26	JM-23	JM-20	JM-1620
Temperature limit	†3000F	†2800F	†2600F	†2300F	†2000F	‡2000F †1600F
Density, lb per cu ft	63—67	58	48	42	35	29
Transverse strength, psi	200	120	125	120	80	60
Cold crushing strength, psi	40	150	190	170	115	70
Linear shrinkage, percent	*0.8 at 3000F	4.0 at 2800F	1.0 at 2600F	0.3 at 2300F	0.0 at 2000F	0.0 at 2000F
Reversible thermal expansion, percent	0.5—0.6 at 2000F	0.5—0.6 at 2000F	0.5—0.6 at 2000F	0.5—0.6 at 2000F	0.5—0.6 at 2000F	0.5—0.6 at 2000F
Conductivity (Btu in. per sq ft per F per hr at following mean temperatures)						
500F	3.10	2.00	1.92	1.51	0.97	0.77
1000F	3.20	2.50	2.22	1.91	1.22	1.02
1500F	3.35	3.00	2.52	2.31	1.47	1.27
2000F	3.60	3.50	2.82	2.70	1.72	....

*24-hr Simulative Service Panel Test; all others 24-hr soaking period. †Back-up or exposed. ‡Back-up only.

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These are Cleveland vertical units in a stone preparation plant. They drive a feeder table which transfers crushed stone from storage bins above to a conveyor belt, on the way to kilns for dead burning.

Trouble-free CLEVELANDS drive dolomite feeder

SERVING day-in, day-out, these Clevelands help to keep the steel mills running. They contribute to the manufacture of dead burned dolomite—a refractory material with which open hearth furnace bottoms are maintained.

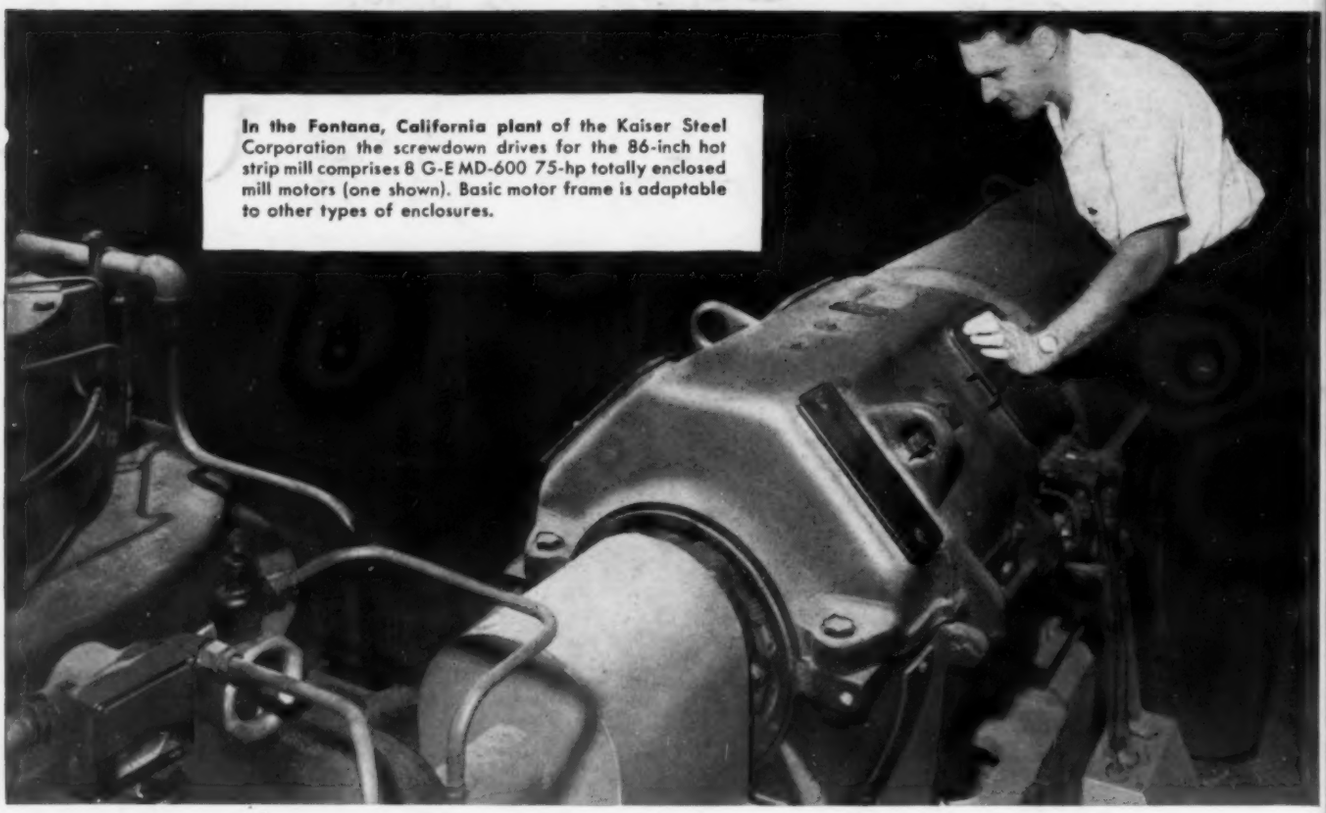
In metal production and fabrication, as well as in the wide spread supporting industries like this one, there are thousands of Cleveland worm gear speed reducers and worm gear drives—many of them in operation thirty years and more.

Since 1912, Cleveland has concentrated its entire engineering and manufacturing effort on a single product—worm gearing. It has always emphasized the four basic factors of correct design, finest quality materials, up-to-date manufacturing facilities and precision workmanship. As a result, wherever industry needs dependable drives—drives that will operate continuously under heavy loads, for long periods of trouble-free service—there you're likely to find Clevelands at work.

In or near your city there's a Cleveland engineer ready to serve you. He will be glad to discuss your power transmission problems and suggest proper drives to meet your particular needs. The Cleveland Worm and Gear Company, 3278 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication.
In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers



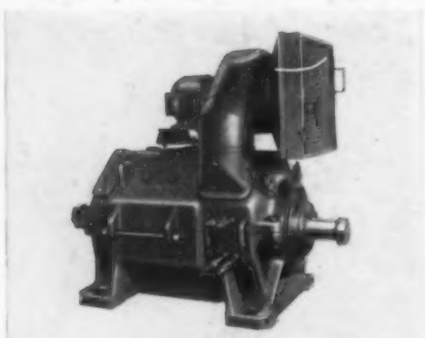
In the Fontana, California plant of the Kaiser Steel Corporation the screwdown drives for the 86-inch hot strip mill comprises 8 G-E MD-600 75-hp totally enclosed mill motors (one shown). Basic motor frame is adaptable to other types of enclosures.

Alternate enclosures for basic motor save cost of extra motors

Conversion feature makes G-E mill motor adaptable to many steel-mill auxiliary applications

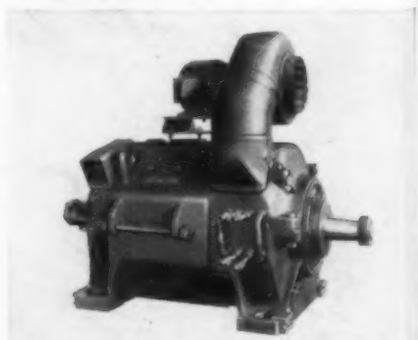
Want versatility in your mill motors—to meet a variety of steel-mill jobs? Get it by standardizing on versatile G-E MD-600 mill motors. Universal frame construction permits adapting the basic motor—quickly, easily—to any one of four types: totally enclosed; totally enclosed with blower and filter; protected, self-ventilated; and protected, with blower. All you do is change the enclosure or blower. That cuts your changeover time, plus storage space and cost of extra standby motors!

What's more, rugged construction and improved insulation gives you longer motor life, while a host of convenience features simplify and speed maintenance. For additional information regarding G-E MD-600 mill motors—and G-E control to help you get the most from them—see your G-E representative. Meanwhile, send for Bulletin GEA-4654. *General Electric Co., Schenectady 5, N. Y.*



Totally enclosed with blower and filter (and totally enclosed, above)—Gasketed covers on all frame openings prevent entry of outside air.

Protected, self-ventilated—Hoods on top air discharge openings at drive end protect motor interior from falling objects.



Protected, with blower—Blower is driven by a Tri-Clad* motor, with both units mounted on bracket over the mill motor itself.

* *Registered trade-mark of General Electric Co.*

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